2004 WASHINGTON SALMON AND STEELHEAD ABUNDANCE INDEX

(TRENDS REGARDING RECOVERY OF POPULATIONS LISTED UNDER THE FEDERAL ENDANGERED SPECIES ACT)

State of Washington
2004 State of the Salmon Report

By

Bruce A. Crawford
Salmon Recovery Funding Board

And

Greg C. Volkhardt
Department of Fish and Wildlife

Laura Johnson, Director
Interagency Committee for Outdoor Recreation
Salmon Recovery Funding Board
1111 Washington Street
PO Box 40917
Olympia, Washington
98504-0917

www.iac.wa.gov

Glossary

Following words are contained in the text and may not be familiar to the reader. Definitions are provided and references where appropriate.

Juvenile migrant. Juvenile salmon and steelhead migrate to the sea after various amounts of time in freshwater. Chum salmon may only spend a few days in freshwater after hatching while sockeye may spend up to four years in a lake before migrating to the sea. Juvenile migrants spending one or more years in freshwater before migrating are often referred to as smolts.

Populations. This term has most recently been applied to fishes listed under the federal Endangered Species Act and is “a group of fish of the same species that spawns in a particular lake or stream (or portion thereof) at a particular season and which, to a substantial degree, does not interbreed with fish from any other groups spawning in a different place or in the same place at a different season.” (McElhany et al. 2000).

Productivity. Productivity is measured as the ratio between the number of juvenile salmon produced from a particular generation of spawning adults (brood year) and the number of spawning adults in the spawning season. Multiplying the number of spawners by the ratio yields the number of new juvenile salmon recruiting to the population. The growth rate of the population over time is the product of the productivities of each generation. Populations must meet or exceed an average productivity ratio of 1:1 in order to be viable. For the purposes of this report, we have only utilized the juvenile migrants as a measure of production. We have not calculated the ratio of spawners to migrants.

Spawn. The reproductive act where the female salmon or steelhead digs a depression (redd) in the gravel of the bottom of the stream and deposits her eggs at the same time that the male is fertilizing the eggs. The eggs are subsequently covered with gravel and incubate until hatching occurs in early spring.

Spawner Abundance. Those adult fish entering their natal river to spawn and that have escaped any high seas, nearshore, or in-river fisheries that may have occurred. In the fisheries management community this is referred to as escapement.

Stock. A defined set of individual fishes usually associated with a specific river or stream and a specific behavior such as time the group of fishes return from the sea. An example would be winter run steelhead from the Skagit River. In some cases due to the inability to discriminate between two or more stocks or populations, a fishery index or abundance estimate may include a conglomeration of stocks. An example would be Nooksack-Samish chinook as reported by the Pacific Fishery Management Council.

Executive Summary

This report creates a stock index approach to measuring salmon and steelhead recovery success similar to the Dow Jones Industrial stock market and is intended as a reference document to the *2004 Washington State of the Salmon Report*. Bull trout are not covered in this report. Of the twelve listed salmon and steelhead species located within the six Salmon Recovery Regions (SRR), all show an improvement in spawner abundance during the recovery period (1999-2003) compared to the base period (1991-1998) ((see Table 1). However during the recovery period composite spawner goals were met in only two of eleven ESUs and only once during the eight years. This would indicate that although abundances increased, there is a need for substantially more progress in the future in meeting recovery goals. The observed improved spawner trend may be the result of one or more of the following factors:

- There may have been a reduction in the percentage of the salmon runs harvested either coast-wide or in Washington waters during the recovery period compared to the base period allowing more salmon and steelhead to reach the spawning grounds;
- There have been a few habitat restoration actions funded prior to 1999 and during 1999 and those actions may have been sufficient to increase the number of juveniles migrating to the sea resulting in a larger total run size.
- There may have been an increase in the overall numbers of spawners because marine conditions have increased the survival of juvenile migrants allowing more fish to return to spawn during the recovery period than during the base period.

From 1979 to 1998, marine survival of Puget Sound coho plummeted from 25% to 5%. Chinook and steelhead exhibited similar declines. Marine survival conditions improved, beginning in 1999, as a result of large-scale ocean climate conditions causing cooler surface sea temperatures in the North Pacific and improved coastal upwelling of nutrients necessary for sustaining forage fish and krill used by salmon and steelhead.

Juvenile migrant trap sites show an improvement in the overall numbers of juvenile salmon migrating to the sea in all six salmon recovery regions for Chinook, steelhead, and coho, where both baseline and recovery period data are available. This trend may be the result of one or more of the following factors:

- There have been sufficient spawners in the past to fully utilize past freshwater habitat, but there has been an improvement in habitat quality due to restoration actions. This has resulted in the production of more juvenile migrants;
- There have <u>not</u> been sufficient spawners in the past, and an increase in juvenile production is due to higher numbers of spawners reaching the stream to spawn and fill empty habitat.
- There have been sufficient spawners in the past to fully utilize past freshwater habitat, but an overall improvement in climate conditions favoring freshwater survival and production has occurred.

It is likely that this improvement may be the first demonstrated result of investments in habitat restoration and protection projects implemented with federal and state funding. Intensive monitoring of selected watersheds has been initiated to confirm the relationship between freshwater production of juvenile salmon and steelhead and restoration actions.

Table 1. Summary of spawner abundance and juvenile migrant trends for Washington ESA listed species

NOAA ESU	Status	Spawner Abundance 1991-2003	Met Target Spawner Goal one or more times 1999-2003	Juvenile Migrant Abundance 1999-2003
Puget Sound Chinook	Threatened	Increasing	No	No Data
Hood Canal summer chum	Threatened	Increasing	Yes	No Data
Lake Ozette sockeye	Threatened	Increasing	No data	No Data
Lower Columbia Chum	Threatened	Increasing	No	No Data
Lower Columbia Steelhead	Threatened	Increasing	No	Increasing
Lower Columbia Chinook	Threatened	Increasing	No	No Data
Lower Columbia Coho	Candidate	No Data	No Data	No Data
Mid Columbia Steelhead	Threatened	Increasing	No	No Data
Upper Columbia Chinook	Endangered	Increasing	No	Increasing
Upper Columbia Steelhead	Endangered	Increasing	No	No Data
Snake River Fall Chinook	Threatened	Increasing	Yes	Unchanged
Snake River Spring Chinook	Threatened	Increasing	No	Decreasing
Snake River Steelhead	Threatened	Increasing	No	Increasing

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Table Of Contents

List of Tables

List of Figures

I. Introduction

This report is intended to provide a high level summary of the progress made in restoring the abundance of Washington State salmon and steelhead populations spawned and reared in the wild to healthy and harvestable levels as described in the state's plan to recover species listed under the federal Endangered Species Act (ESA), *"Statewide Strategy to Restore Salmon, Extinction is not an Option"* published in 1999. In order to provide a comparison for the reader, we have chosen to compare the average spawner abundance of selected stocks from 1991 to 1998 with the average abundance of those same stocks from 1999 to 2003.

The Dow Jones Industrial Average is the most widely used indicator of the overall condition of the stock market. It is a price-weighted average of 30 actively traded blue chip stocks, primarily industrials. The 30 stocks are chosen by the editors of the Wall Street Journal (which is published by Dow Jones & Company), a practice that dates back to the beginning of the century. The Dow is computed using a price-weighted indexing system.

We have chosen salmon and steelhead stocks with accurate long-term wild/natural spawner abundance and juvenile migrant data distributed across each of Washington's salmon recovery regions as our State of the Salmon Index (SSI). The adult spawner data is not a true index in that it uses the actual abundance estimates for each stock included in the index. The larger salmon stocks have not been weighted to dampen their influence on the overall increase or decrease in relative abundance of the SSI when compared to other stocks. This was done because real abundance numbers were needed to compare against the established or preliminary spawner goals. On the other hand, the juvenile migrant data as shown in the charts in this report is a true index where migrant numbers are weighted to reduce the bias caused by larger rivers with large numbers of migrants. This report attempts to create an index that the public, and congressional and legislative leaders, can readily understand and interpret. This report does not contain information on ESA listed bull trout because there are not adequate data to provide a status report by region.

A. Adult Spawner Abundance

This report is intended to address the management questions:

- ***Have salmon and steelhead spawner abundances improved since the State began implementing the "Statewide Strategy to Recover Salmon" in 1999? If so, why? If not, why?***

- ***Are we meeting salmon and steelhead spawner goals necessary for recovery and de-listing of ESA species? If so, why? If not, why?***

Adult spawners are the building blocks for future fish production and represent those adult fish entering their natal river to spawn and that have escaped any high seas, nearshore, or in-river fisheries that may have occurred. Without adequate deposition of eggs from these spawners in the river of origin, it is not possible to maximize the carrying capacity of the stream to produce juvenile salmon. Stream carrying capacity is dependent upon the quality of habitat and the annual natural variations in survival due to climate, predation, and disease.

There are about 435 salmon and steelhead stocks identified in Washington State. This report tracks the spawner abundance of 123 of those stocks. Because the 123 stocks with the greatest amount of information have not been chosen randomly under accepted statistical methods, the information collected about them cannot be construed to represent the status of all of 435 stocks within the Evolutionarily Significant Units (ESU) as described under the ESA. However, the stocks utilized in this index are the largest and most important stocks in Washington both in terms of salmon recovery efforts and in terms of economic impact to commercial and sport fisheries.

The current adult SSI assessment contains uncertainties that future reports should be able to improve or quantify. Sources of uncertainty in this report include the following:

- **Interim spawner targets**. Spawner targets and target ranges are in many cases interim goals and have yet to be approved. The target goals are expected to become more certain as the NOAA Fisheries technical review teams and the state SSRs complete their work in developing regional recovery plans for the state in 2005.
- **Hatchery spawners counted as natural production**. Spawner abundance numbers are for those salmon and steelhead spawning in the natural environment and considered offspring of natural fish production. This is not in all cases true where hatchery fish have not been marked and where hatchery fish may be commingled with fish produced from naturally spawning fish. Surplus hatchery fish spawning can artificially inflate spawner abundance estimates and falsely indicate progress in restoring abundance of naturally produced fish.
- **Biased reporting of stocks within the ESU.** Many of the stocks have very limited available information, while other stocks are well known and have extensive data collected over many years. Those stocks having the greatest amount of information available tend to be the strongest and largest populations where historic commercial and sport harvest have required detailed information to meet allocation requirements under various federal court rulings (US v Washington, US v Oregon). It is unfeasible at this time to produce a report on an annual basis that tracks all 435 stocks. This is done periodically (every ten years) when the Salmon and Steelhead Stock Inventory (SASSI) is updated by the Washington Department of Fish and Wildlife and the treaty tribes.
- **Insufficient recovery years to reflect habitat restoration actions.** The life history of salmon is elongated enough that the population changes from egg to adult span both base period and recovery periods for Chinook and steelhead. Restoration actions to improve freshwater production are marginally reflected in data collected through 2003. For example, spawning Chinook salmon adults returning during the base period (1991-98) were hatched and experienced freshwater mortality pressures during the spring and summers of 1987-94. Conversely, the Chinook salmon spawners returning to spawn during the recovery period (1999-2003) were hatched and experienced freshwater mortality pressures during the spring and summers of 1995-1999. From this illustration it is apparent that the juvenile Chinook migrating in 1999 were the only brood year that experienced even the beginning of the major restoration actions underway over the past five years.

These infirmities and others in this report will be analyzed and improved in the next report as more information becomes available. Completing the mass marking of hatchery salmon per requirements under federal law and state rules will allow future quantification of hatchery contributions to spawner abundance estimates. More years of data will allow for better comparisons of baseline years to salmon and steelhead cohorts spawned and returning in the recovery period.

B. Marine Productivity

This report is intended to address the management question:

- ***Has survival of salmon and steelhead in the marine environment improved? If so, why? If not, why?***

The North Pacific Ocean is the "grazing" area for Washington Pacific salmon and steelhead produced in our freshwater streams. Steelhead tag recoveries on the high seas have documented that steelhead migrate as far as the waters beyond the International dateline and approach the coast of Japan and beyond the Aleutian Islands. Chinook, sockeye, and pink salmon tend to migrate along the coast of British Columbia to Southeast Alaska and the Kenai Peninsula. Coho tend to travel either north along the coast and up to Vancouver Island, Canada or south along the coast of Oregon. Variations in annual climate can affect the amount and location of food organisms and also affect the number of predators encountered by salmon and steelhead.

C. Freshwater Productivity

This report is intended to partially address the management question:

- ***Is juvenile salmon and steelhead freshwater productivity improving due to habitat protection and restoration actions? If so, why? If not, why?***

Intact and functional freshwater habitat is critical to producing the maximum number of juvenile salmon and steelhead from the eggs deposited into the gravel. Sedimentation, loss of riparian cover, temperature, extreme flow conditions, poor water quality, and other factors can severely reduce egg to migrant survival. Regardless how ideal ocean conditions may be, if few salmon migrate to the sea, there will be fewer salmon returning to spawn in Washington streams. State, federal, and local governments have invested millions of dollars in habitat restoration activities designed to improve freshwater survival and distribution of salmon and steelhead. Efforts are underway to monitor project effectiveness and overall improvements to freshwater salmon populations. Direct measurement of juvenile migrant salmon and steelhead is the most accurate method over time to determine the status and trends in freshwater productivity.

The current juvenile migrant SSI assessment also contains uncertainties that future reports may be able to improve or quantify. Sources of uncertainty in this report include the following:

- **No juvenile migrant production targets**. Juvenile migrant production targets and target ranges are just now being considered for listed species and have never been developed for other unlisted species. The juvenile migrant target goals are essential to and part of the target goals set for adult spawner returns from the ocean.
- **Insufficient number of juvenile migrant traps**. Existing juvenile migrant traps are sprinkled sparsely across the state and trap specific watersheds on an annual basis. Many important stocks are not evaluated and most of the existing traps have not been calibrated to determine whether the sites trapped reflect other river systems nearby in the ESU that have no migrant traps.
- **Little or no baseline migrant trap data.** Most juvenile trap sites were not implemented until after listings occurred. This has made it more difficult to correlate recovery period abundance with the baseline.

These infirmities and others in this report will be analyzed and improved in the next report as more information becomes available.

II. Indexing Method

A. Adult Spawner Abundance

Data have been obtained from the Pacific Fisheries Management Council (PFMC) document *Review of 2003 Ocean Salmon Fisheries* (PFMC 2004), the tribal-state *Puget Sound Comprehensive Chinook Management Plan, Harvest Management Component* (PSIT and WDFW 2003), and the *Salmonid Hatchery Inventory and Effects Evaluation Report* by NOAA Fisheries (NOAA Fisheries 2004). Other salmon and steelhead spawner information was provided by Washington Department of Fish and Wildlife. Some Columbia River salmon data have been obtained from the *"Status Report Columbia River Fish Runs 1938-2000"* (WDFW and ODFW 2002). For many of the PFMC managed stocks, the stock is a combination of two or more SASSI stocks and it was necessary to estimate the ratio of index to total SASSI stocks. The spawner abundance information for each stock by species by year for each SRR were averaged for each of the years 1991 through 1998 to produce a baseline average abundance for each of the stocks that are part of the species index for the SRR. All of the stock abundances are also summed to produce a total number of spawners for each year and the overall averages of each stock for 1991-1998 are summed to produce the overall average abundance of the stocks in the index over the eight years prior to the recovery plan. In the same manner, the individual stock spawner abundance estimates from 1999 to 2003 were averaged to produce a recovery period average abundance. All of the stock abundances are also summed to produce a total number of spawners for each year and the overall averages of each stock for 1999-2003 are summed to produce the overall average abundance of the stocks in the index over the four years since the recovery plan was published and restoration actions were implemented.

B. Marine Productivity

Prevailing winds, ocean currents and other large-scale climate factors create coastal upwelling, which brings nutrient rich deep waters to the surface. When this occurs, the nutrient rich waters combined with surface photosynthesis creates ideal conditions for marine algae (phytoplankton) and the resultant marine zooplankton and baitfish that feed upon the algae. Important food organisms for salmon and steelhead, part of the zooplankton include shrimps, krill, herring, sardines, anchovies, and other baitfish. Sea surface temperatures are a simple way of correlating increased marine food chain productivity. Variations in salmon marine survival have been correlated with fluctuations in sea surface temperatures. Fluctuation tends to occur every 20 years and is known as the Pacific Decadal Oscillation (PDO). When sea surface temperatures are cooler than normal off of the coast of Washington and British Columbia, Washington salmon survival is higher, and when the temperatures are warmer than usual, salmon survival in the ocean is lower. We have used data available from the University of Washington Climate Impact Group and available on their website at http://www.cses.washington.edu/cig/.

C. Freshwater Productivity

Juvenile migrant trapping sites are essential for monitoring salmon recovery. Most trap sites have only been operational since ESA listings began, therefore, in many cases there are no baseline data to compare freshwater production from 1991-1998 to the recovery period 1999-2003. The data in this report represents the information obtained from 19 trap sites sprinkled across the state. In the past, freshwater production estimates from these sites have been developed and published in annual reports on a watershed-by-watershed basis. This index is the first attempt to put together these results into a regional assessment of the freshwater juvenile migrant production. More trap sites and a randomized sampling strategy are needed in order to produce a more accurate trend analysis of freshwater productivity.

Example of How the Freshwater Productivity Index is Calculated

The State of Washington has made a substantial investment in developing a network of juvenile wild salmon downstream migrant (smolt) production monitoring sites throughout the state. These sites measure smolt production for a variety of listed and unlisted salmon species. These data are used to monitor the status and trends in freshwater production for salmon populations from individual streams, analyze the influence of biological and environmental changes (including human influences) on salmon production, and for forecasting run strength for fishery management. The freshwater productivity index was developed as an approach to assemble data from various monitoring sites (i.e. rivers) into a regional index of productivity for the purpose of determining the relative status and production trends of salmon populations within the region.

The index was calculated for Chinook, coho, and steelhead populations from the smolt production data available within each Salmon Recovery Region (SRR). The following two-step process is used to create each regional index:

1. The annual deviation in smolt production (annual smolt production minus the mean annual smolt production) from a trap site is divided by the standard deviation of the mean annual smolt production for the site; and
2. Annual indices developed in Step 1 are averaged across all sites in the region each year.

A property of the index is that since the annual deviations are standardized in Step 1, the effect of differences in the inter-annual variability in smolt production between streams is limited. Annual smolt production can vary greatly in some streams and vary little in others. Standardizing greatly reduces the effects of different levels of variability on the index. Another property of the index is that indices from different populations within a region are not weighted by population size. For example, the production influence for Puget Sound Chinook is equally affected by changes in the Bear Creek (few hundred adults) population as it is by changes in the Skagit River population (many thousands of adults).

Since recovery of listed salmon populations began in earnest in 1999, we opted to use 1991 to 1998 as a base period and contrast production from 1999 and later to this pre-recovery period. In some cases, insufficient data from the 1991 to 1998 period was available to provide this contrast; therefore, two versions of the index were developed depending on the number of years of data available. Where sufficient years of pre-99 data were available, the index was calculated using the pre-99 mean and standard deviation in Step 1 above. This approach was used to develop indexes for Puget Sound coho and steelhead, coastal coho and steelhead, Lower Columbia steelhead, Snake River fall and spring Chinook and steelhead, and Upper Columbia spring Chinook. Where little if any monitoring occurred prior to 1999, the mean and standard deviations from all years of monitoring was used to calculate indices in Step 1. Therefore, instead of contrasting pre-99 production levels with those from later years, this approach only provides a trend over the monitoring years available. This later approach was used for Puget Sound Chinook, Lower Columbia coho, and Upper Columbia steelhead. In some cases (e.g. coastal Chinook), insufficient data existed to calculate an index.

The following example describes the development of the Lower Columbia steelhead production index. In this case, many years of pre-99 data exists to compare the pre-99 period with production from later years.

Lower Columbia Steelhead Production Index

In the Lower Columbia SRR, steelhead production is monitored in seven streams: Mill, Abernathy, and Germany Creeks, Kalama, Cowlitz, and Wind Rivers, and Cedar Creek (NF Lewis tributary). For the index, we selected data sets from the Kalama River, Cowlitz Falls, and Wind River sites to calculate the index since unlike the other four streams, smolt trapping in these streams extended at least two years prior to 1999 (Table 2).

Table 2. Annual wild steelhead smolt production estimated from three monitoring sites in the Lower Columbia River Salmon Recovery Region.

Variable	Trapping Year	Trapping Station Kalama River	 Cowlitz Falls	 Wind River
A	1992	23,768		
	1993	8,558		
	1994	26,218		
	1995			
	1996			
	1997		7,714	21,442
	1998	15,902	24,505	25,297
	1999	21,552	25,368	22,812
	2000	31,724	26,184	19,690
	2001	43,679	30,861	25,327
	2002	45,381	9,300	9,374
	2003	49,832	21,565	21,049
B	pre99 Mean	21,962.67	16,109.5	23,369.5
C	pre99 stdev	5,389.748	11,873.03	2,725.897

The standardized annual deviations (SAD) are calculated each year for each stream using the variables in Table 2 by subtracting the pre99 mean (Variable B) from the annual production (Variable A) and then dividing the difference by the pre99 standard deviation of the mean (Variable C). For example to calculate the 1992 SAD for the Kalama River production, the pre-1999 mean Kalama steelhead smolt production (21,962.67 smolts) is subtracted from the 1992 production (23,768 smolts) and divided by the standard deviation of the pre-1999 mean (5,389.748 smolts), which results in an SAD of 0.334957 (Table 3). The Index of Production is the mean SAD across each of the sites monitored that year. Since only the Kalama River was monitored in 1992, the Index of Production was the same as the 1992 SAD from the Kalama River. In 1999, it was calculated by the mean of the SADs from the Kalama River (-0.07619), Cowlitz Falls (0.779793), and Wind River (-0.20452), which resulted in an index value of 0.16636. What this 1999 value indicates is that although production from the Kalama and Wind Rivers were slightly below their pre-1999 mean productions (negative SADs), the high production from Cowlitz Falls pulled the index into positive territory. In this case, index values above zero indicate better production than the pre-99 base period. For regions where pre-1999 data is unavailable, positive index values simply indicate production is better than the average of the data available.

Table 3. Standardized annual wild steelhead smolt production deviations and index of production for the Lower Columbia Salmon Recovery Region.

Trapping Year	Standardized Annual Deviations			Index of Production
	Kalama River	Cowlitz Falls	Wind River	
1992	0.334957			0.334957
1993	-2.48707			-2.48707
1994	0.789524			0.789524
1995				
1996				
1997		-0.70711	-0.70711	-0.70711
1998	-1.12448	0.707107	0.707107	0.096578
1999	-0.07619	0.779793	-0.20452	0.16636
2000	1.811093	0.84852	-1.34983	0.436594
2001	4.029193	1.242438	0.718112	1.996581
2002	4.344977	-0.57353	-5.13427	-0.45427
2003	5.170804	0.459487	-0.85128	1.593004

Statistically astute folks will note that the values of the SADs and the Index of Production are in standard deviation units. Therefore, since the smolt data are normally or close to normally distributed, there are probabilities associated with the magnitude of the Index and SAD values. For example, Index values above 0.67 shouldn't occur more than 25% of years. This feature makes analysis of the Index fairly straight-forward and simple.

III. Results and Discussion

A. Adult Spawner Abundance

Have salmon and steelhead spawner abundances improved since the State began implementing the "Statewide Strategy to Recover Salmon" in 1999?

Yes. Most of the trend information between the base period and the recovery period indicates a positive improvement over the past few years in adult spawners statewide. However, this improvement must be evaluated with caution in view of the prolonged life history characteristics of salmon.

If so, why?

The observed improved spawner trend may be the result of one or more of the following factors:

- There may have been a reduction in the percentage of the salmon runs harvested either coast-wide or in Washington waters during the recovery period compared to the base period allowing more salmon and steelhead to reach the spawning grounds;
- There have been a few habitat restoration actions funded prior to 1999 and during 1999 and those actions may have been sufficient to increase the number of juveniles migrating to the sea resulting in a larger total run size.
- There may have been an increase in the overall numbers of spawners because marine conditions have increased the survival of juvenile migrants allowing more fish to return to spawn during the recovery period than during the base period.

The evidence in this report would indicate that all three factors are at work. For example, a Chinook salmon that hatched in the spring of 1999 would not return to the natal stream until 2003 or 2004. Therefore, we cannot say that all of the improvements in the recovery period are due to the impact of salmon restoration projects upon adult abundance. However, the positive outcome of salmon habitat restoration projects will be realized more in the coming years as their cumulative effects begin to build in each watershed. In that event it can be expected that future State of the Salmon Reports will be able to document a continual improvement in abundance.

Are we meeting salmon and steelhead spawner goals necessary for recovery and de-listing of ESA species?

No. Of the listed species in Washington, none have consistently met their combined spawning targets during the recovery period and only a few have met or exceeded the spawner targets more than once.

If not, why?

There are three major reasons why spawner targets have not been met. One, the abundance targets have been re-evaluated for many stocks and increased. For other stocks there were no previously established goals. Two, ongoing harvest associated with Alaska, Canada, and the southern US continue to take a portion of the salmon available for spawning. Three, the freshwater habitat in many areas is not capable of producing sufficient juvenile migrants to create adult spawners necessary to meet spawner targets for healthy salmon populations due to long term habitat degradation.

The following tables and charts have been developed to illustrate what is known about changes in salmon spawner abundance from a Base Period (1991-1998) and the Recovery Period (1999 to present) for species listed under the ESA, and also for other species as well by Salmon Recovery Region (SRR). The spawner abundance tables can be interpreted using the following descriptions of each column and what it represents.

Species

Column 1 of the Tables identifies the species. "Species" are marked with an asterisk "*" if the species is listed under the ESA in the specified SRR.

Stocks

For each species reported, the "*Stocks"* column contains two numbers (e.g. 14/22). The first number is the number of recognized SASSI or NOAA Fisheries Technical Review Team (TRT) stocks within the SRR with long-term data that were used in calculating the index. The second number is the total number of stocks in the recovery region. This allows the reader to evaluate what confidence may be placed in the index as a reflection of the overall number of stocks. The actual stocks used are identified in the Appendix.

Base Period

"*Base Period Avg"* is the Average spawner abundance calculated for each stock over the base period and then summed over all of the stocks in the SSI. The base period is 1991-1998 and represents the average spawner abundance prior to the implementation of Washington's SSRS.

Recovery Period

"*Recovery Period Avg"* is the Average spawner abundance calculated for each stock over the recovery period up to the year with the most recent data (1999-2003) and then summed over all of the stocks. In some cases, the most recent year data is 2002.

Percent Change

"*Percent Change"* is the weighted Average percent change in abundance of all of the stocks for that species for the recovery period taken from the Average abundance from the base period. .

Target Goal

"*Target Goal"* is the combined minimum spawner abundance for each group of stocks used in the index needed to seed the spawning grounds. For species listed under the ESA, the goals represent either SRR goals, where available, or guidelines submitted by NOAA Fisheries to the Northwest Power and Conservation Council. It should be stressed that at this time recovery goals are provisional and tentative. They do not represent NOAA Fisheries Technical Review Team spawner planning ranges which are much more conservative. It should also be noted that spawner targets are, by their nature, imprecise and have an associated annual variance about the number. Where species are not listed under ESA, the target goals represent goals established under either US v Washington or US v Oregon sub-proceedings and are the goals utilized by the Pacific Fishery Management Council and the Pacific Salmon Commission to regulate harvest and are based upon maximum sustainable harvest (MSH) production curves.

Percent of Goal

"*Percent of Goal"* is the weighted percent of the spawning goal that has been achieved during the recovery period.

Puget Sound Salmon Recovery Region (Shared Strategy)

Table 4 reflects the overall stock abundance status and trend for Puget Sound listed and unlisted stocks. The Shared Strategy goal for recovery is self-sustaining populations of salmon at harvestable levels. Recovery planning ranges and targets have been developed for 14 of the 22 independent Chinook populations identified by the Puget Sound Technical Recovery Team (TRT)(Appendix 3). The ranges and targets give a sense of the magnitude of the effort necessary to return Chinook populations to recovered, harvestable levels.

The planning range, developed by the TRT, provides a broad estimate of the abundance needed for a population to be viable over time (e.g., 100 yrs.)(Appendix 3). The ranges are large because of the variation in environmental conditions and uncertainty in historical information. The planning targets, developed by WDFW and individual Puget Sound tribes for specific Chinook populations, provide a more specific measure within the range that is helpful to evaluating recovery actions in habitat, harvest, and hatcheries. The targets predict the abundance and productivity of individual salmon populations based on a fully functioning estuary, improved freshwater conditions, restored access to blocked habitats, and poor ocean conditions.

There are two composite recovery planning targets displayed under “Target Goal” for Chinook salmon - 205,540 (low productivity) and 48,180 (high productivity)(Appendix 3). Both of these numbers will rise when recovery planning targets are developed for the other eight independent Chinook populations. Low productivity targets represent one adult fish return per spawner (1:1). High productivity targets represent the highest sustainable returning adults per spawner and varies (2.3:1 – 3.8:1).

Current productivity for the 22 independent Chinook populations of Puget Sound is less than one adult returning for each spawner.

The kinds of actions needed to achieve these recovery planning targets may include protection and restoration of estuary, nearshore, and freshwater habitats, as well as management changes for harvest and hatchery activities. All of these actions have important implications for the people living and working in the watershed. Accordingly, Shared Strategy is working with individuals at the watershed level where it is possible to consider critical social, economic, and cultural implications as well as the biological needs of the fish that are unique to each watershed.

See Appendix 3 for comparisons of NOAA TRT planning ranges for spawner abundance, WDFW and tribal planning targets used by the Shared Strategy (Puget Sound SRR), and WDFW and tribal Puget Sound Management Plan Targets.

Figure 1 depicts the trend in 14 of the 22 natural Chinook stocks in Puget Sound since 1991.

Table 4. Puget Sound SRR Spawner Abundance Index

PUGET SOUND SPAWNER ABUNDANCE (Data taken from Tables 15-20 Appendix 1)						
Species	**Stocks Index/Total**	**Base Period Avg 1991-1998**	**Recovery Period Avg 1999-2002**	**Percent Change**	**Target Goal**	**% of Goal**
Chinook*	14/22	17,091	28,870	**+69**	205,540[1] 48,180	**14** **60**
Chum, Summer*	15/15	6,254	18,276	**+192**	14,240[1]	**128**
Coho	9/40	170,863	279,150	**+63**	232,750[2]	**120**
Pink	8/15	700,325	1,932,500	**+176**	680,000[2]	**284**
Chum	11/11	513,640	577,285	**+12**	336,450[2]	**172**
Steelhead	4/54	12,244	7,938	-35	12,000[3]	**66**

* = Stocks listed under the Endangered Species Act

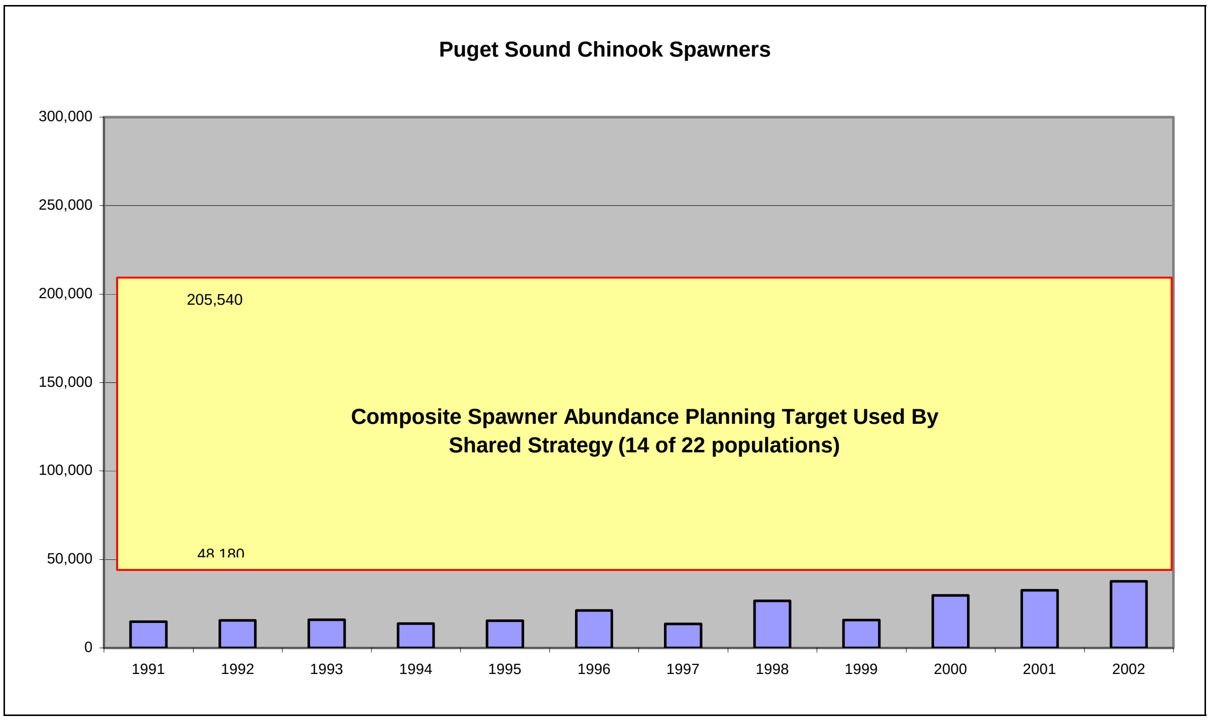

Figure 1. Composite spawner abundance estimates for 14 of 22 Chinook populations in Puget Sound.

[1] Shared Strategy interim recovery ranges
[2] PFMC target based upon US v WA sub-proceedings
[3] WDFW SASI Report

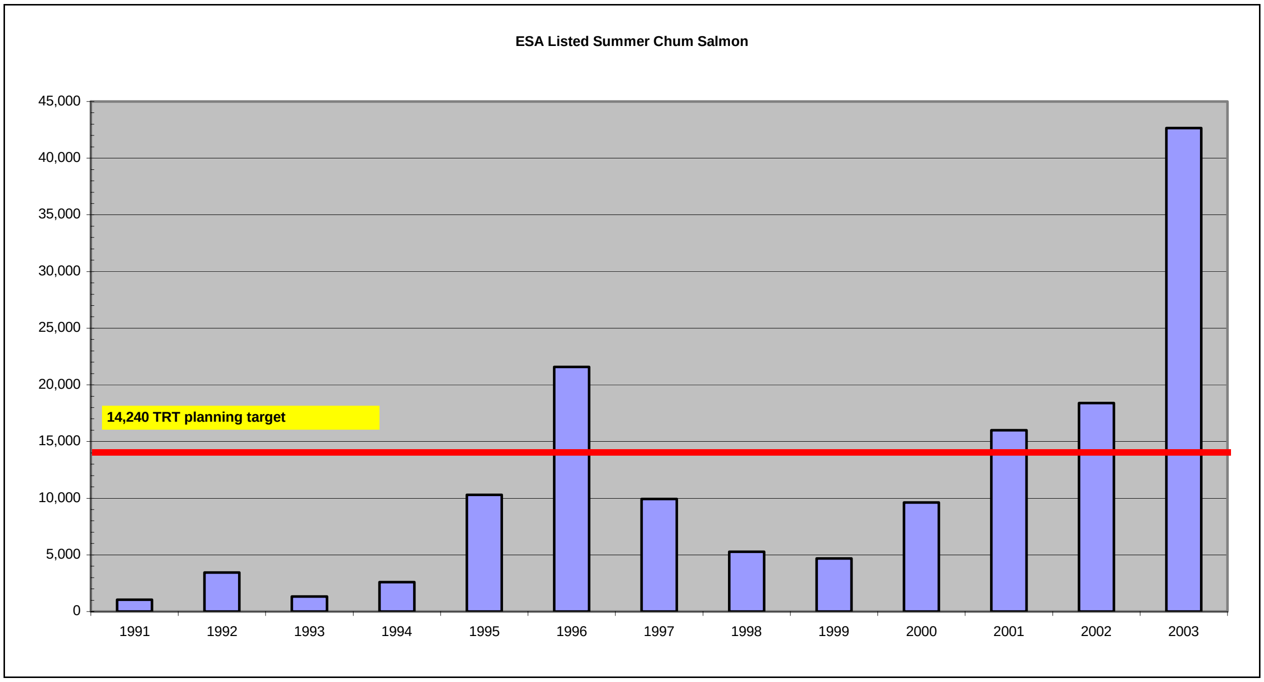

Figure 2. Spawner abundance of ESA listed chum salmon in Hood Canal 1991-2003.

Coastal Salmon Recovery Region

Table 5. Washington Coastal SRR Spawner Abundance Index

COASTAL SPAWNER ABUNDANCE (Data taken from Tables 22-26 Appendix 1)						
Species	**Stocks Index/Total**	**Base Period Avg 1991-1998**	**Recovery Period Avg 1999-2003**	**Percent Change**	**Target Goal**	**% of Goal**
Sockeye*	1/3	1,156	1,453	**+26**	No Data	No Data
Chinook	19/32	41,005	28,520	**-30**	29,200[2]	**82**
Coho	15/32	54,572	82,211	**+51**	49,500[2]	**166**
Chum	8/17	56,403	68,149	**+21**	56,400[2]	**121**
Steelhead	5/45	24,227	27,975	**+15**	23,762[2]	**118**

There are currently no coastal species listed except Ozette Lake sockeye listed as Threatened. The Makah Tribe monitors this population, which is located on reservation land.

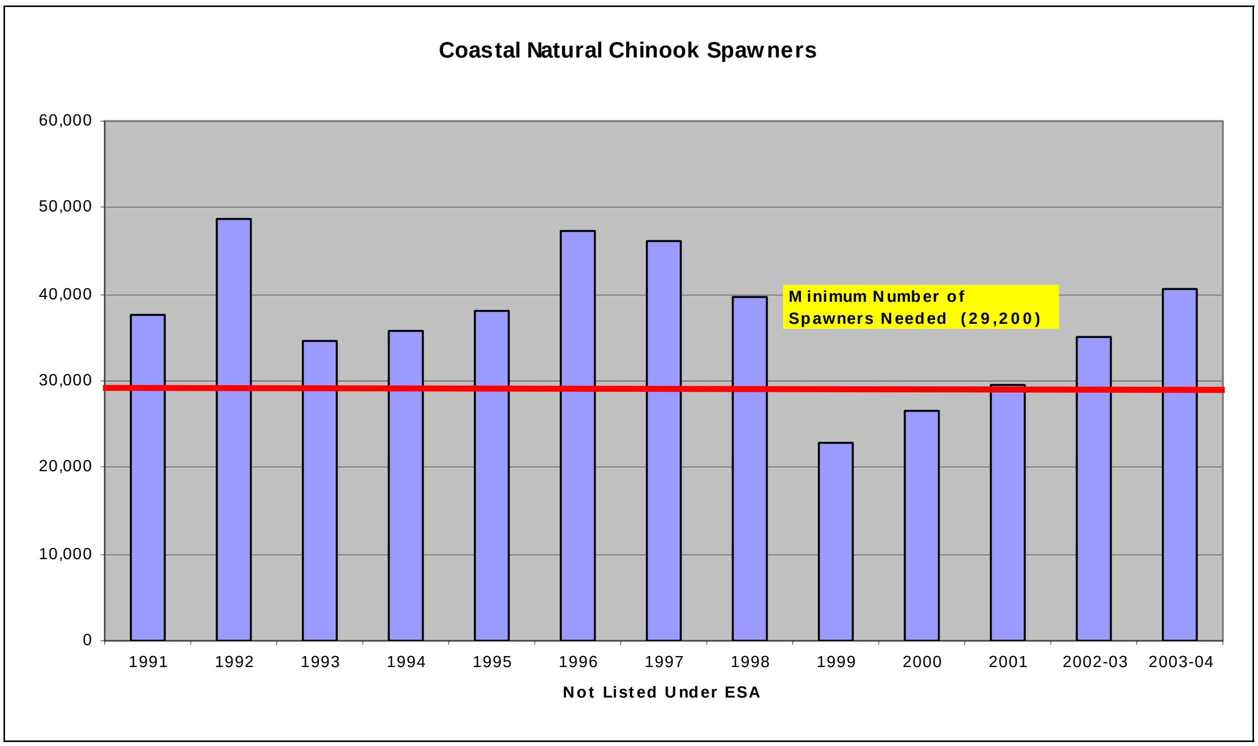

Figure 3. Washington coastal Chinook composite spawner abundance.

Lower Columbia Salmon Recovery Region

Table 6. Lower Columbia River SRR Spawner Abundance Index

LOWER COLUMBIA RIVER SPAWNER ABUNDANCE (Data taken from Tables 27-29 Appendix 1)						
Species	Stocks index/total	Base Period Avg 1991-1998	Recovery Period Avg 1999-2002	Percent Change	Target Goal	% of Goal
Chinook* Fall Tule	2/20	991	1,004	**+1**	4,900[4]	**20**
Chinook* Bright	1/1	8,829	12,355	**+40**	6,500[2]	**190**
Coho*	0/17	NO DATA	NO DATA	NO DATA	NONE	NO DATA
Chum*	2/10	193/mile	692/mile	**+259**	1,519/mile[4]	**46**
Steelhead*	10/29	3,286	5,286	**+61**	6,693[4]	**79**

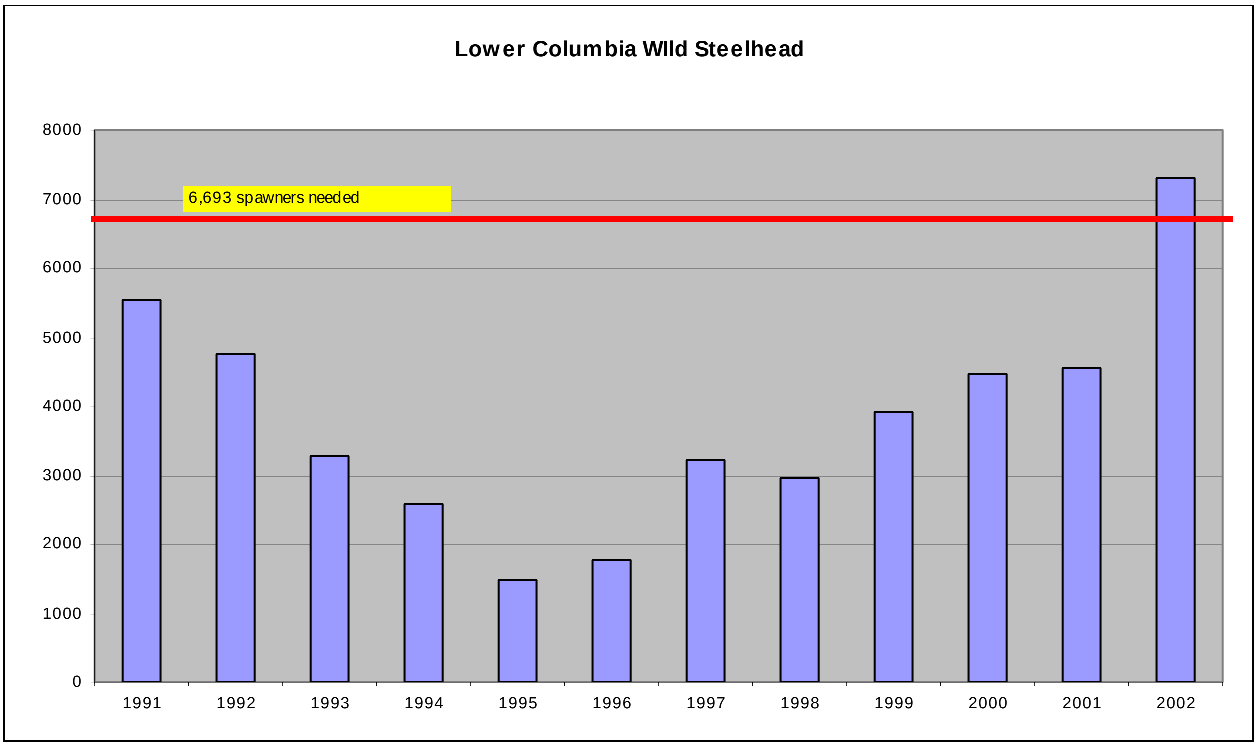

Figure 4. Lower Columbia Steelhead combined stock abundance for ten Winter run stocks.
No applicable data are available for Lower Columbia Washington shore coho. NOAA Fisheries has used Oregon data to assess status of the ESU because populations are not enumerated in Washington. Cedar Creek trap on the North Fork Lewis River (NFL) has provided counts in the past few years but there is no comparable earlier database. WDFW has surveyed coho more extensively the past two years, including hatchery and wild splits, but have not made population estimates.

Spawner abundances for all Lower River Wild Chinook stocks, including Sandy River returns were reported in Table B-17 of the PFMC review document (PFMC 2004). In order to avoid adding in Oregon stocks, this index uses the latest information from the 2003 PSC Joint

[4] Lower Columbia Fish Recovery Region draft goal

Chinook Technical Team report (PSCJTCT 2003), which reflects North Fork Lewis River returns only. EF Lewis and Coweeman returns are included as part of the index and represent tule fall Chinook. These are the only two populations without hatchery fish mixed in the naturally spawning return. They were given equal weight to the combined tule populations and the North Fork Lewis to reflect averages and percent of goal. Target goal for the NFL is the 5,700 PSC goal and the Lower Columbia Draft Recovery Plan draft goals for EF Lewis and Coweeman populations were used for the natural tule stocks. There is no good index for spring Chinook at this time. Natural spawning is heavily mixed with hatchery fish and reintroduction is just underway in the upper Cowlitz and a couple years away in the upper NF Lewis River. These areas above hydroelectric facilities reflect 90% of the spring Chinook habitat.

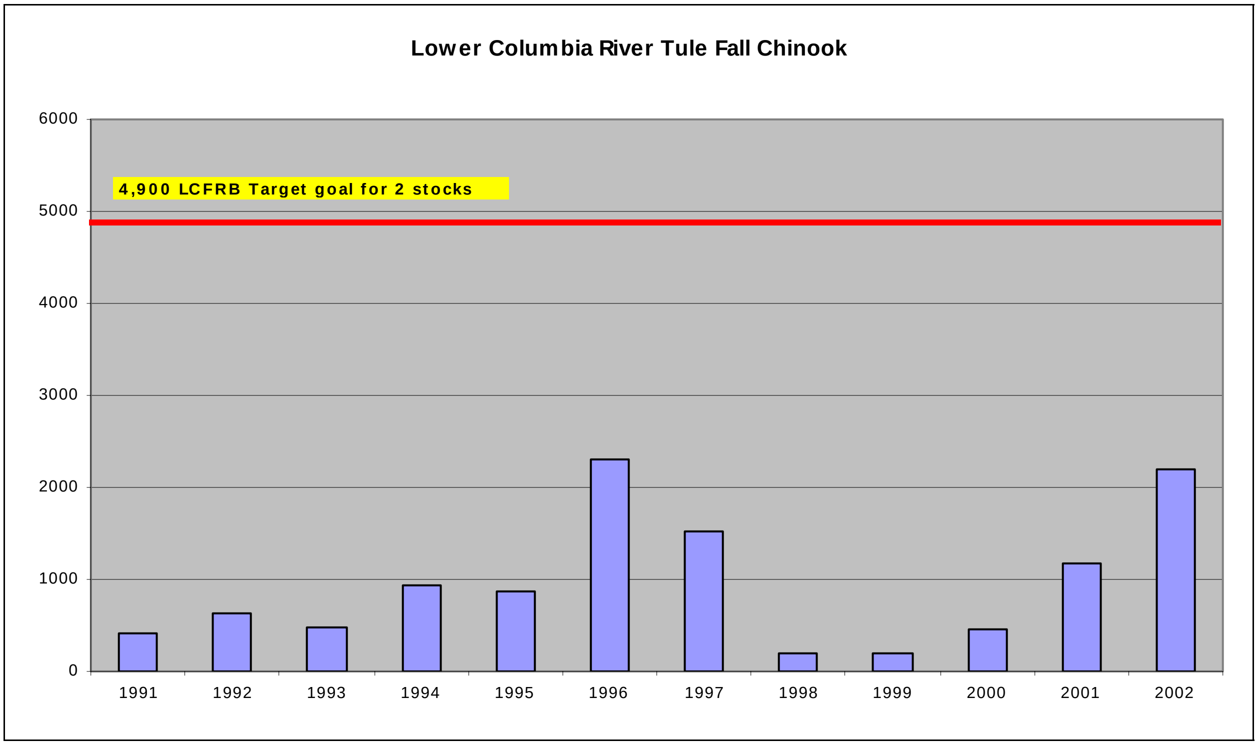

Figure 5. Lower Columbia wild Chinook spawners.

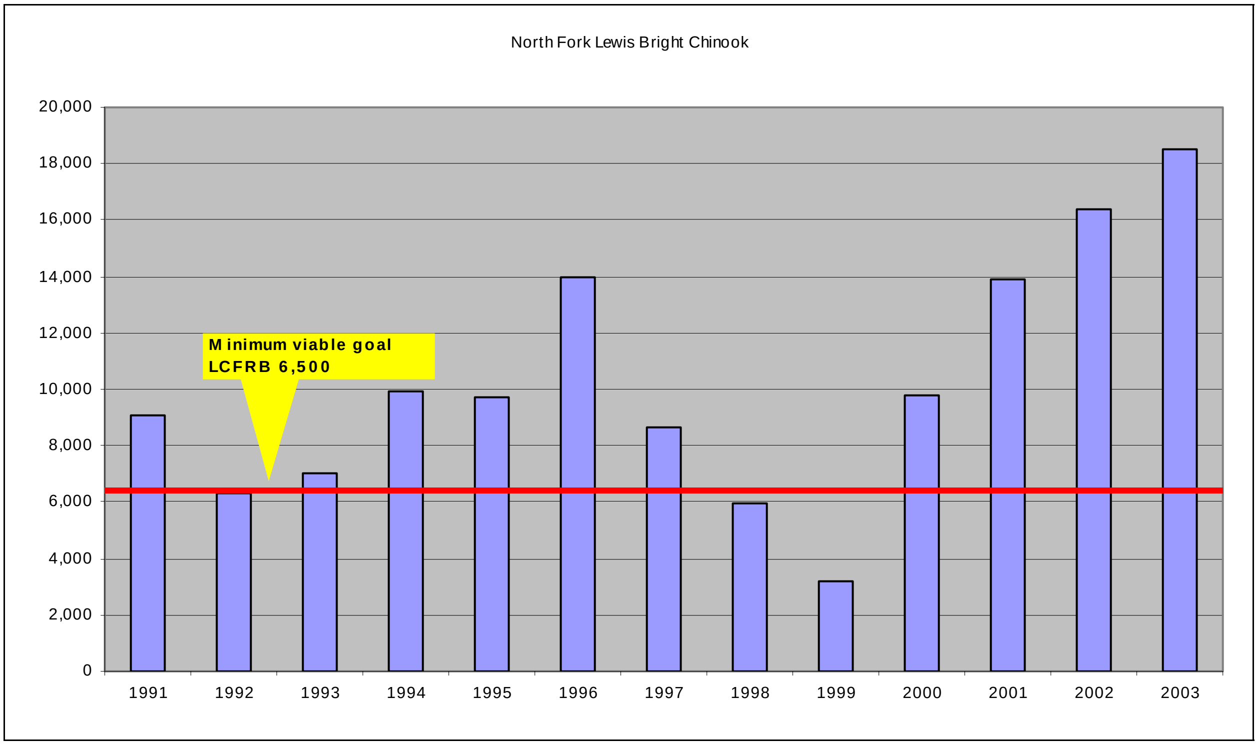

Figure 6. NF Lewis bright Chinook spawner abundance
The lower Columbia River spawner abundance index reflects the status of index stocks only. These stocks were selected because they are represented by long-term databases enabling comparison between the base period and recent year abundance. ESA recovery criteria include biological objectives for all populations within the ESU, as well as criteria for the viability of combined populations within three separate geographical strata of the lower Columbia. Although this summary reflects population trends and goals for these index populations, it does not necessarily reflect the status of the species relative to ESA recovery criteria.

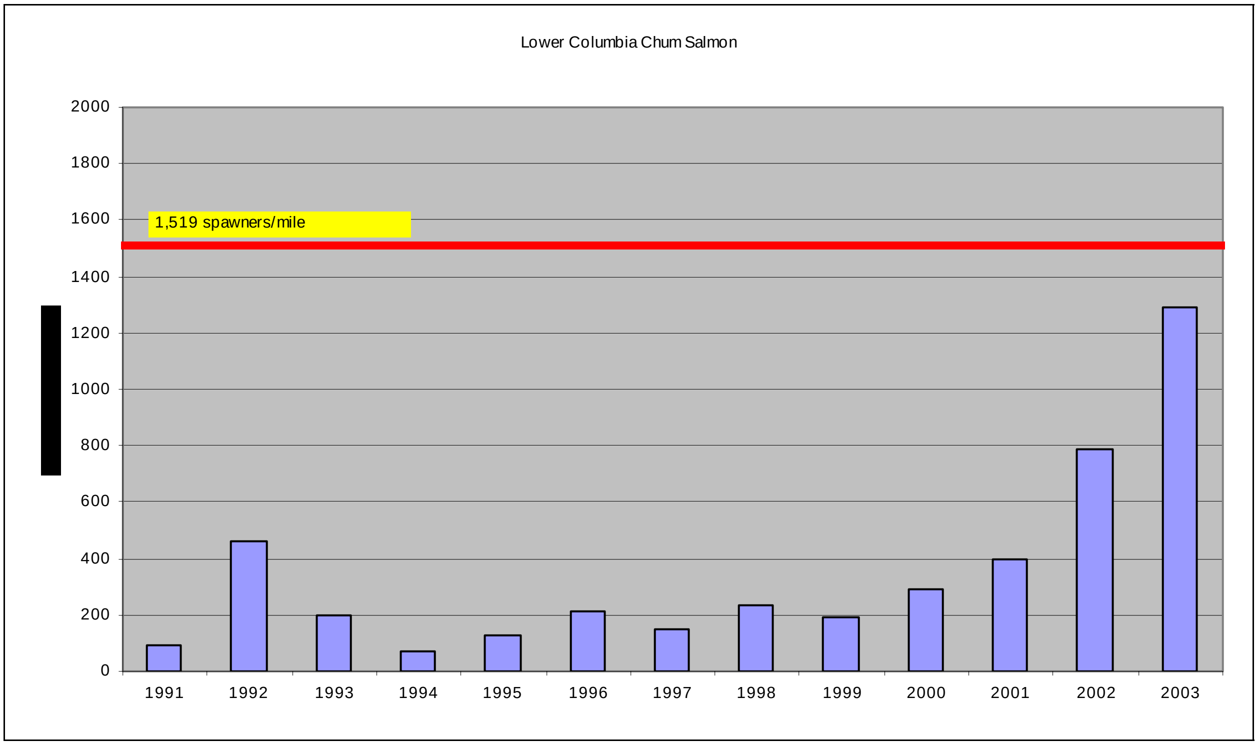

Figure 7. Lower Columbia River chum spawners in terms of spawners per mile.

The table represents chum abundance in terms of chum fish/mile. These data have been collected in the long-term index areas, Grays River, Hamilton Cr, and Hardy Cr. The combined index fish/mile is displayed to reflect percent of goal. The Lower Columbia Draft Recovery Plan goals for all 10 populations (22,800) were added and compared with the 2002 abundance estimate for Washington lower Columbia populations. Surveys that include more watersheds than the index areas have only been conducted since 2001 and are not included in the index. Population estimates were made in 2002, a large return year, with a total of 19,403 spawners. This table compares the fish/mile in the combined index areas for 2002 (1293/mi) and expands it by 22,800/19,403 to get an index goal of 1,519 fish/mi as an indicator for a 22,800 goal for all populations. The 1999-2002 average fish/mi is 692, reflecting 46% of 1,519.

Mid-Columbia Salmon Recovery Region

Table 7. Mid-Columbia River SRR Spawner Abundance Index

MID-COLUMBIA RIVER SPAWNER ABUNDANCE (Data taken from Table 30 Appendix 1)						
Species	**Stocks Index/Total**	**Base Period Avg 1991-1998**	**Recovery Period Avg 1999-2002**	**Percent Change**	**Target Goal**	**% of Goal**
Steelhead*	2/6	1,440	3,068	**+113**	13,100[5]	**23**
Chinook	1/11	63,950	99,225	**+55**	40,000[2]	**248**

Steelhead stocks in the Walla Walla and Yakima are well below spawner abundance needs, but there has been an improvement during the recovery period.

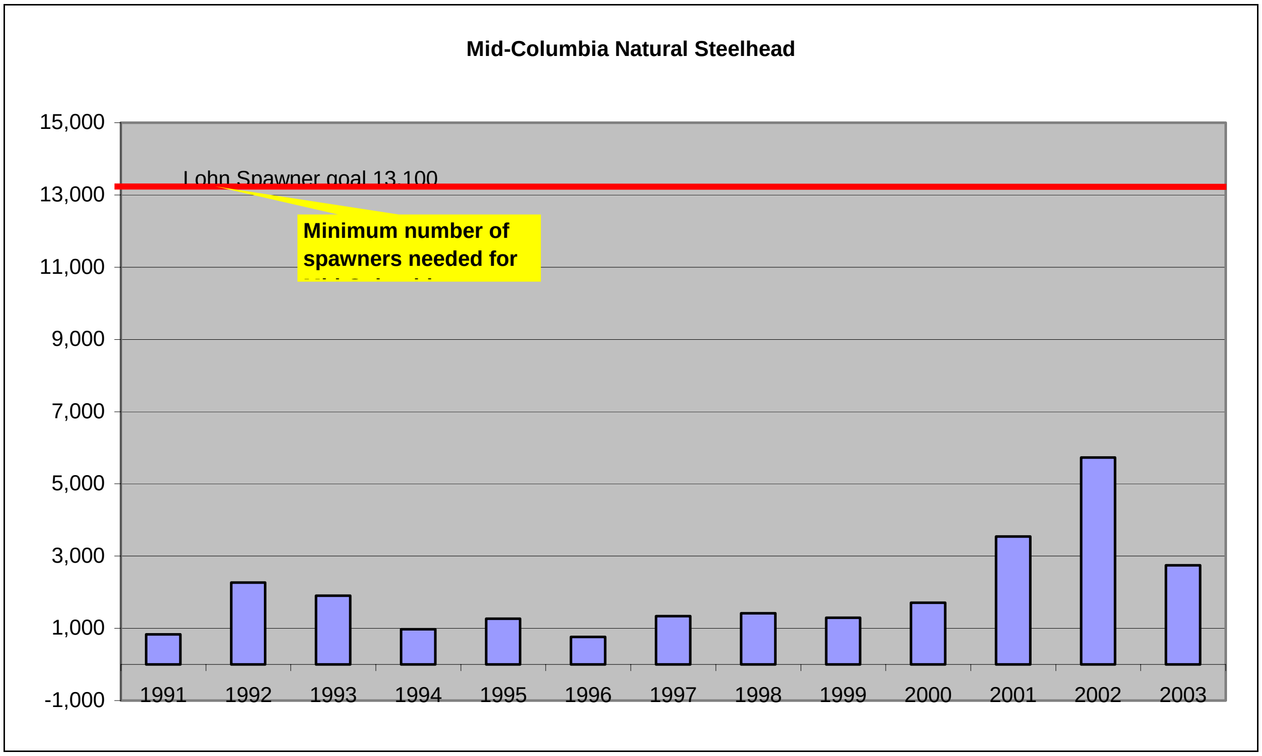

Figure 8. Mid-Columbia natural steelhead spawners Walla Walla and Yakima Rivers.

[5] Lohn. 2002. Interim Abundance Targets For Columbia River Salmon and Steelhead. NOAA Fisheries.

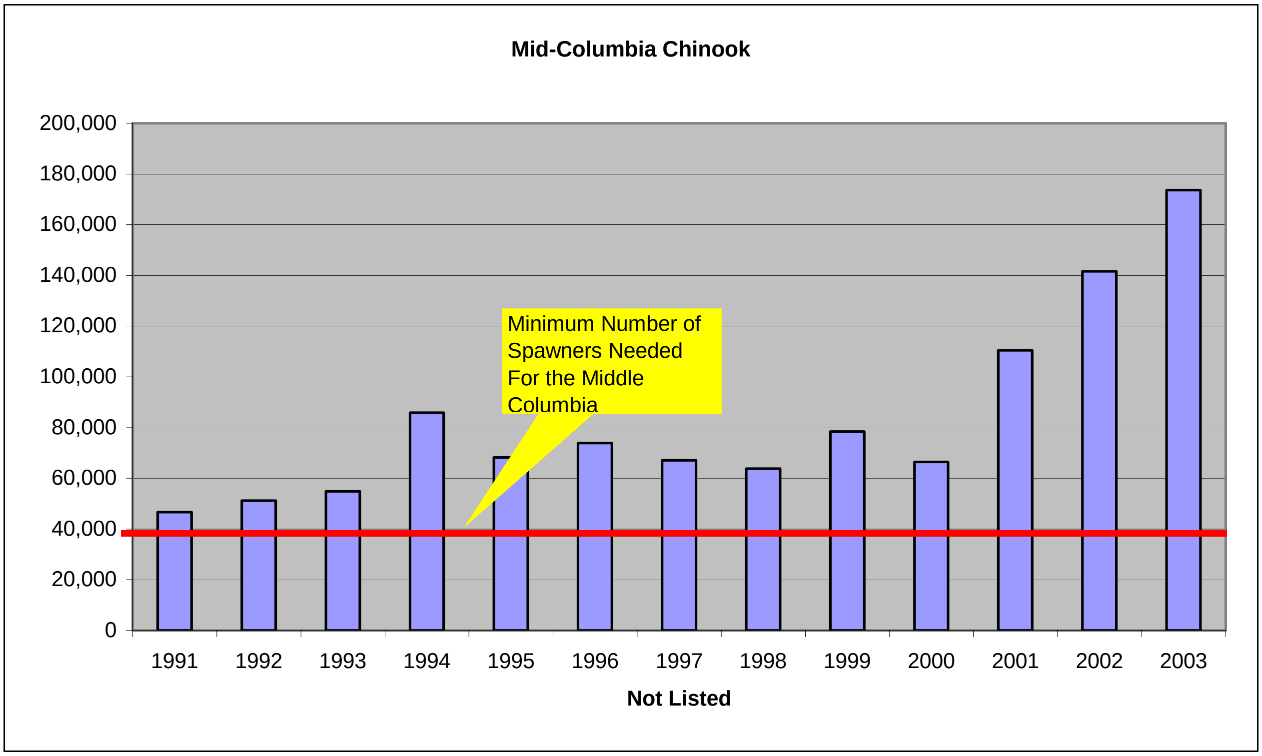

Figure 9. Mid-Columbia upriver bright Chinook spawn in the free flowing portion of the Columbia River absent the impoundment effects of dams.

Upper Columbia Salmon Recovery Region

Upper Columbia chinook and steelhead have been affected by the large number of dams that the juvenile migrants and upstream spawners must negotiate to return to spawn. Lake Wenatchee sockeye are continuing to do well.

Table 8. Upper Columbia River spawner abundances.

UPPER COLUMBIA RIVER SPAWNER ABUNDANCE (Data taken from Tables 31-32 Appendix 1)						
Species	**Stocks Index/Total**	**Base Period Avg 1991-1998**	**Recovery Period Avg 1999-2002**	**Percent Change**	**Target Goal**	**% of Goal**
Chinook*	3/12	927	1,320	**+42**	6,250[5]	**21**
Sockeye	1/1	41,163	49,450	**+20**	23,000[5]	**215**
Steelhead*	1/3	709	2,117	+**199**	2,500[5]	**85**

Upper Columbia naturally spawning Chinook index includes Wenatchee, Entiat, and Methow River stocks (Figure 10).

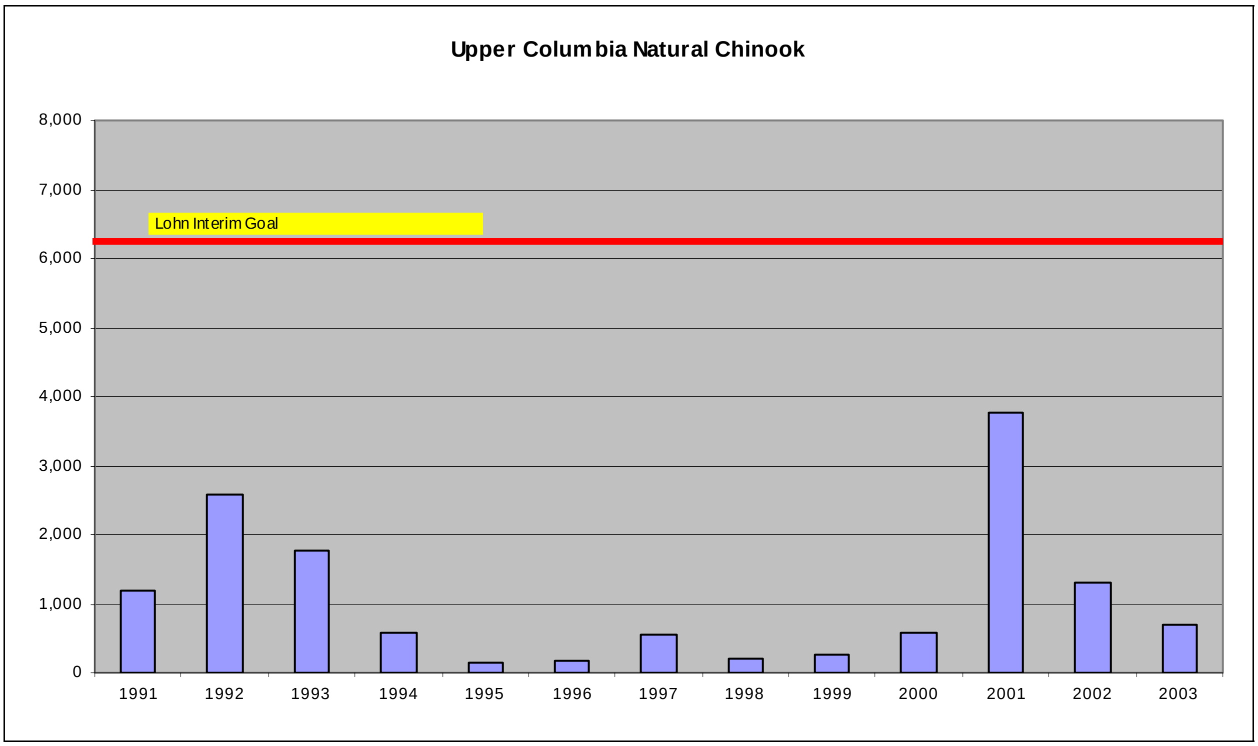

Figure 10. Upper Columbia combined stock abundance compared to combined spawner target for three stocks of Chinook salmon.

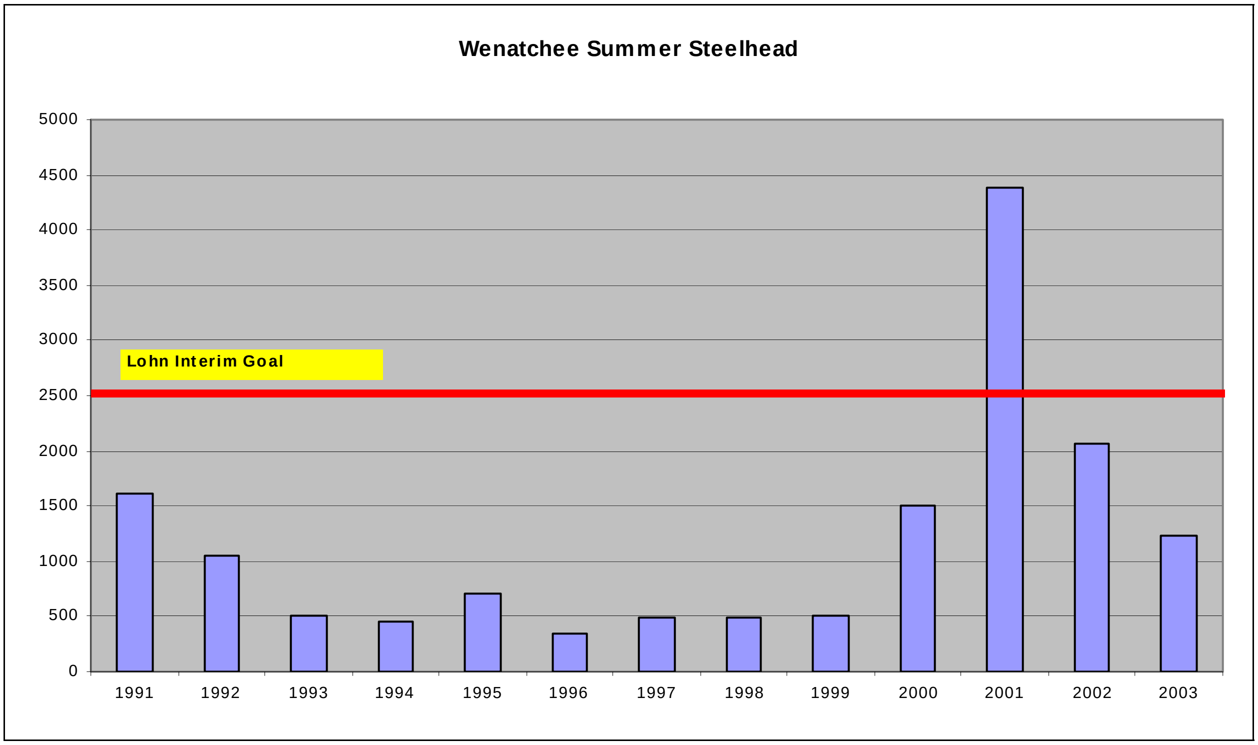

Figure 11. Upper Columbia summer steelhead spawner abundance, Wenatchee River.

Snake River Recovery Region

Table 9. Snake River SRR spawner abundance index.

SNAKE RIVER SPAWNER ABUNDANCE (Data taken from Tables 33-34 Appendix 1)						
Species	Stocks Index/Total	Base Period Avg 1991-1998	Recovery Period Avg 1999-2002	Percent Change	Target Goal	% of Goal
Spring Chinook*	1/1	3,743	13,620	**+263**	25,000[5]	**55**
Fall Chinook*	1/1	513	2,597	**+406**	2,500[5]	**+104**
Steelhead*	2/5	380	504	**+33**	1,700[5]	**30**

Snake River Chinook spawner abundance is a conglomerate of Idaho, Oregon, and Washington spawners as measured at Lower Granite dam and includes spring and fall Chinook. At this time there are no reliable data for spawners only occurring in Washington waters. Lower Monumental dam counts are more representative of Washington only stocks, but target goals have not yet been developed for counts at this dam. Steelhead data is taken from Washington stocks only.

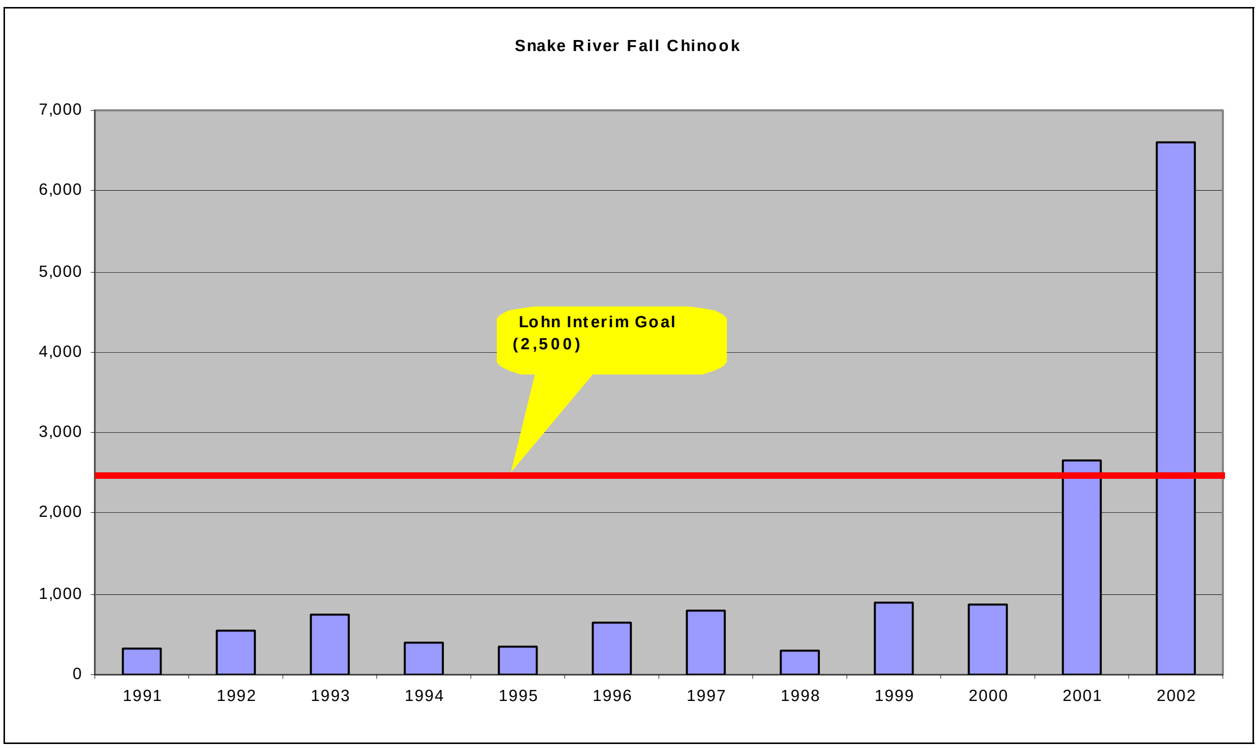

Figure 12. Snake River Chinook spawner abundance.

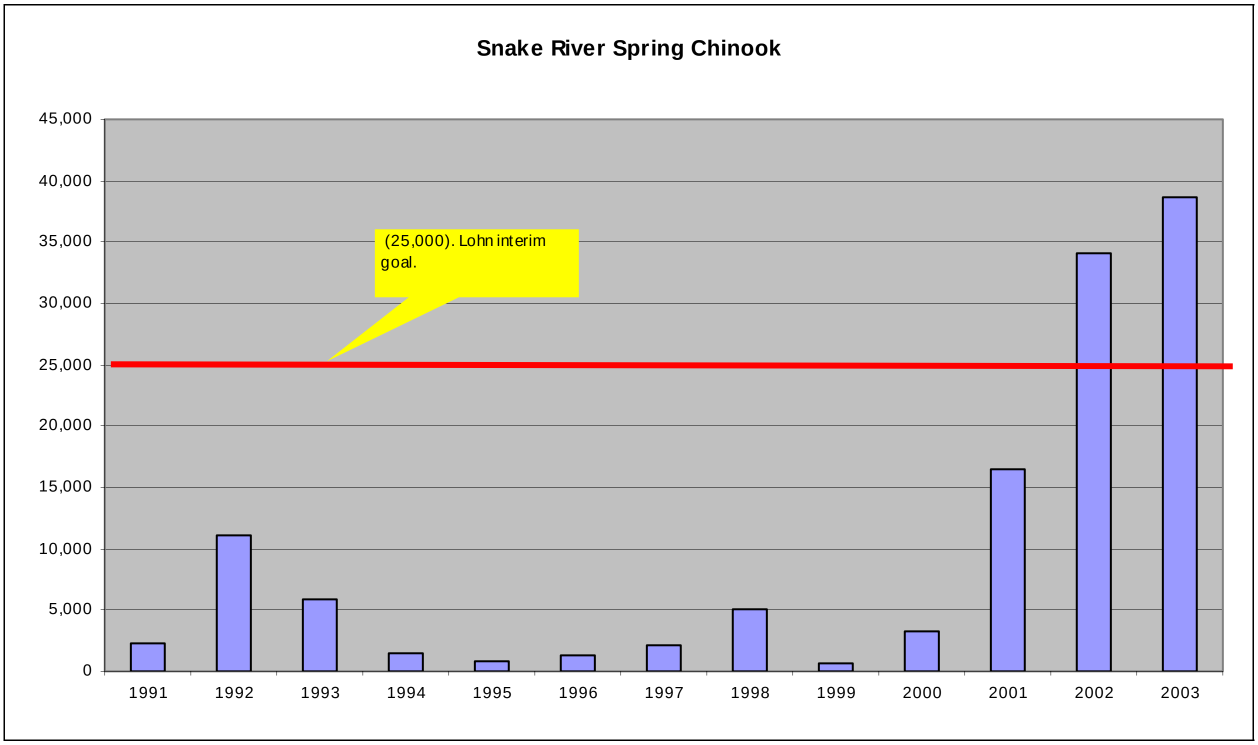

Figure 13. Snake River Spring Chinook adult spawner abundance.

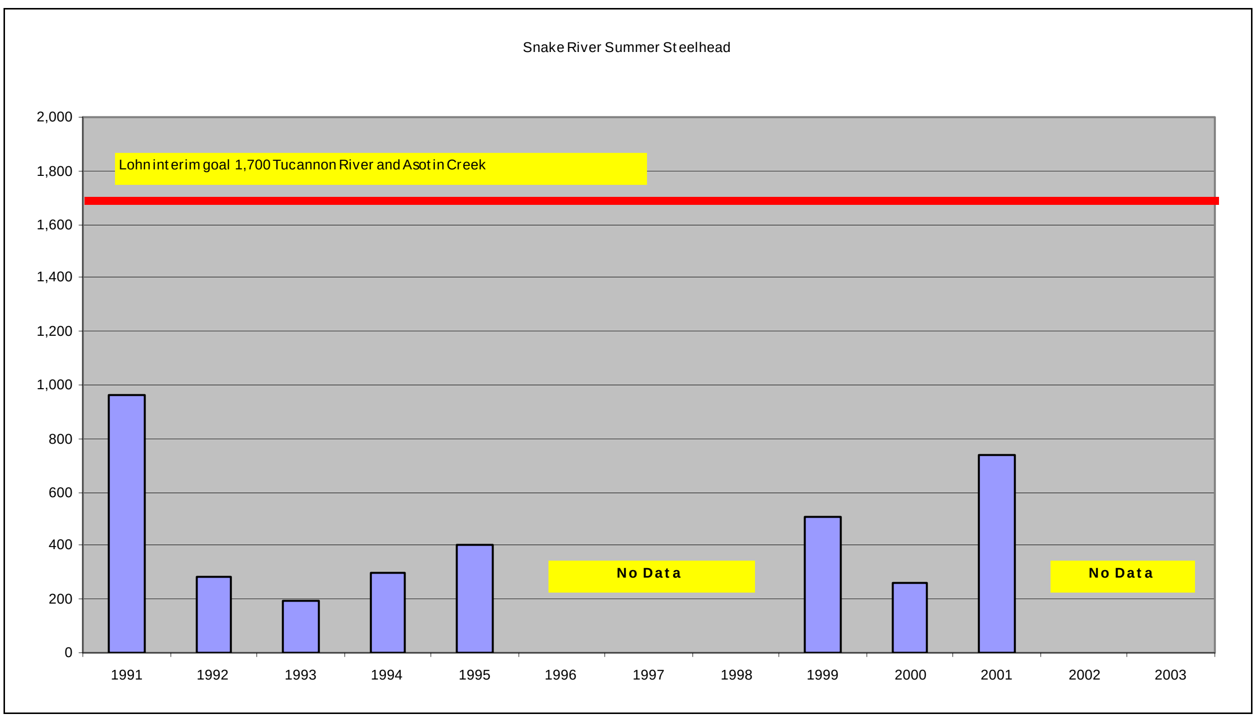

Figure 14. Snake River steelhead composite spawner abundance (Asotin and Tucannon rivers).

B. Marine Productivity

Has survival of salmon and steelhead in the marine environment improved?

Yes. Marine survival seems to be improving beginning in 1999. For Puget Sound coho salmon it appears that marine survival has improved from a low of 5% in 1997-98 to 15-20% in the years 1999-2003.

If so, why?

Figure 15 shows the PDO since 1900. As can be seen from this chart, the Pacific Northwest has experienced 20 years of warmer surface sea temperatures beginning in 1979 and apparently ending in 1999. Figure 16 reflects adult coho marine survival between 1979 and 2000. The trend line reflects the continual decline in marine survival during this oscillation period. Since 1999, sea surface temperatures generally developed a more favorable trend for Washington salmon and steelhead. Although the oscillation appears to have turned, there are still years when temperatures will be higher than average. These may be correlated with El Nino events and other climate changes. In recent years, 1992, 1995, and 2003 were years where the temperatures were opposite of the prevailing oscillation trend.

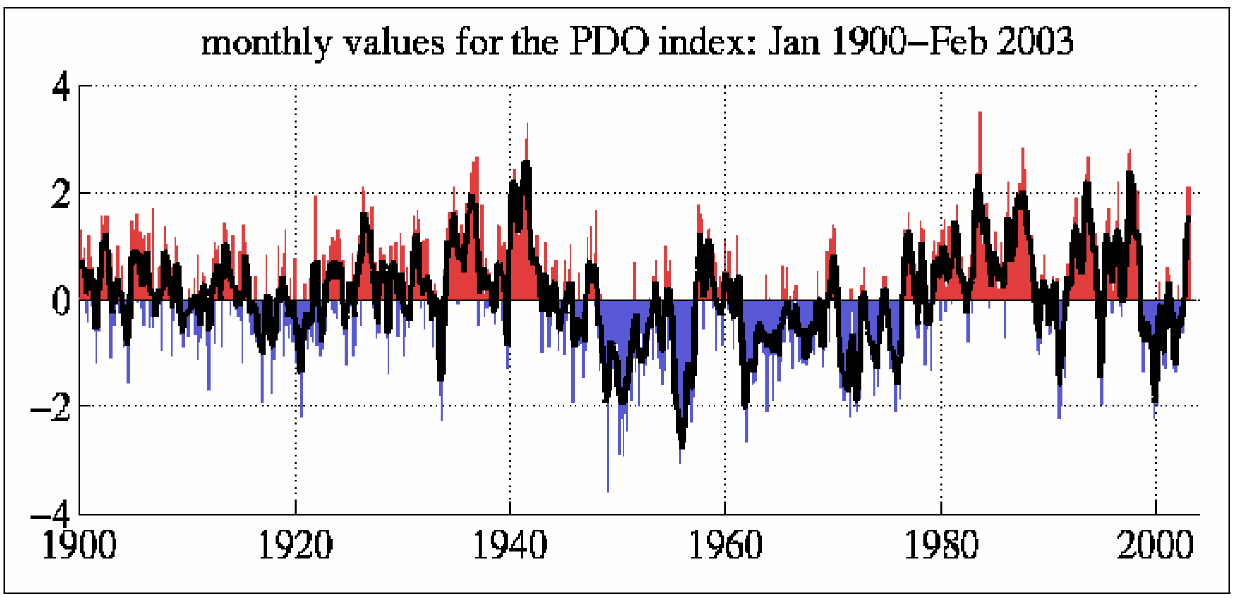

Figure 15. Pacific decadal oscillation. Red represents warmer than usual temperatures and blue cooler than usual temperatures. (Data source Climate Impact Group University of Washington)

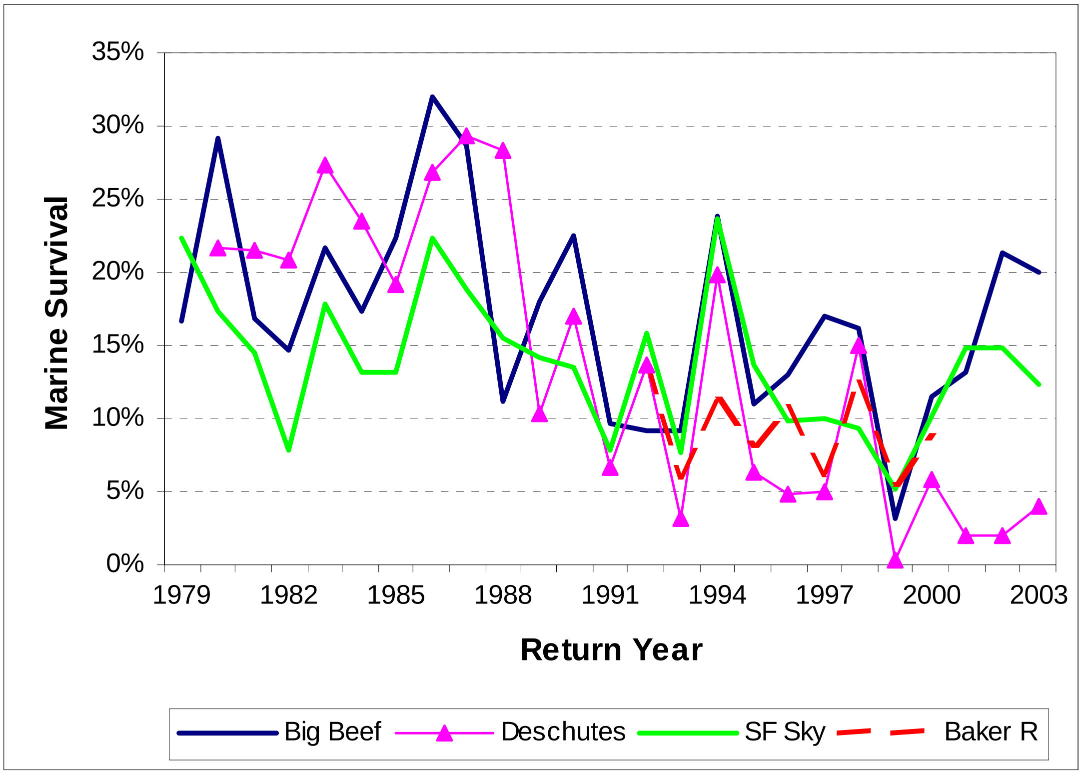

Figure 16. Marine smolt to adult survival of Puget Sound coho salmon stocks (Data source Washington Department of Fish and Wildlife, Fish Program)

Because salmon stay at sea for 2-4 years, the effects of a shifting PDO upon migrant salmon is not apparent until two years later for most stocks. Figure 17 below shows the annual sea surface temperature fluctuations from 1991-2003 compared to mid-Columbia Chinook salmon during the same time period.

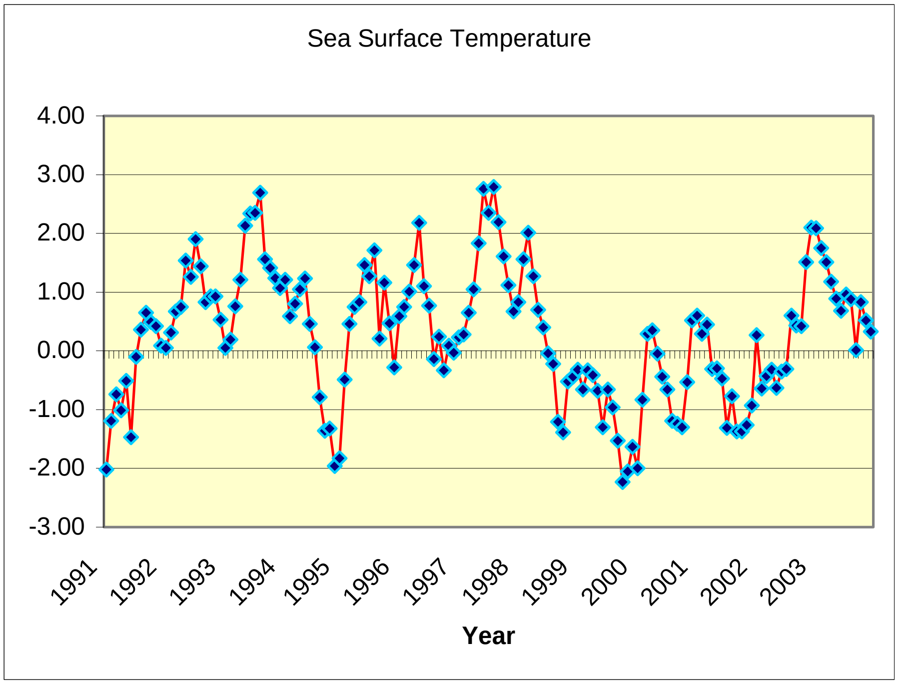

Figure 17. Pacific surface temperature fluctuations from 1991-2003.

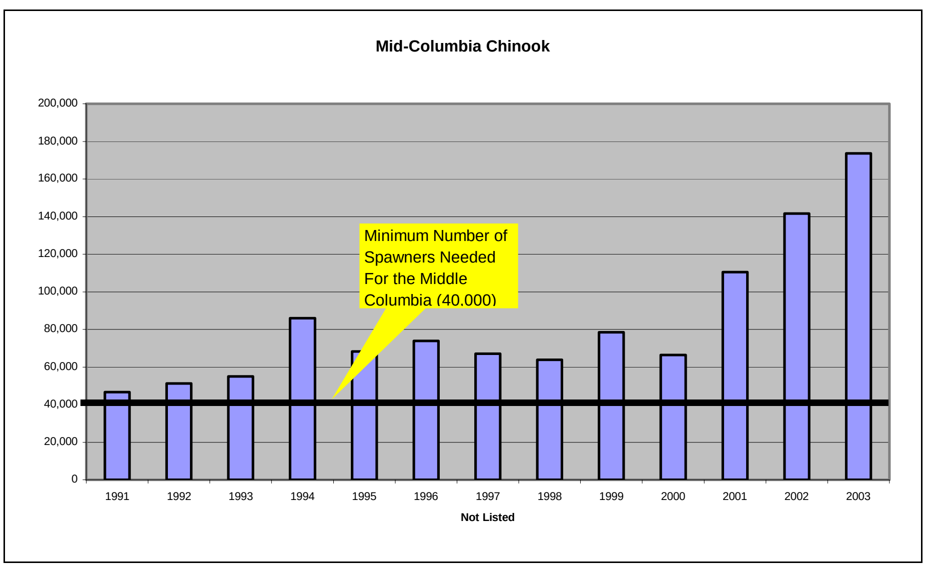

Figure 18. Mid-Columbia Chinook spawner abundance.

C. Freshwater Productivity

Is juvenile salmon and steelhead freshwater productivity improving?

Yes. Most of the trend information indicates a positive slope over the past few years in juvenile migrant production statewide.

If so, why?

This trend may be the result of one or more of the following factors:

- There have been sufficient spawners in the past to fully utilize past freshwater habitat, but there has been an improvement in habitat quality due to restoration actions. This has resulted in the production of more juvenile migrants;
- There have not been sufficient spawners in the past, and an increase in juvenile production is due to higher numbers of spawners reaching the stream to spawn and fill empty habitat.
- There have been sufficient spawners in the past to fully utilize past freshwater habitat, but an overall improvement in climate conditions favoring freshwater survival and production has occurred.

Five intensively monitored watersheds have been identified and the funding established to directly determine the cause and effect relationships between restoration and management actions and juvenile migrant production, and to firmly establish which of the above scenarios is actually occurring. The watersheds where the intensive monitoring will occur are listed in Table 10 below.

Table 10. Location and species addressed at intensively monitored watersheds (IMW).

IMW Location	Species CH-Chinook CO-coho SH-steelhead CT-cutthroat	Smolt record (years)	Land use	Restoration type	Projects needed[3]	Time to results (years)
Strait of Juan de Fuca	CO, SH, CT	4	Federal/private forest	Inchannel/ riparian	Few	2-6
Kitsap Peninsula Puget Sound	CO, SH, CT	12-25	Urban/rural residential, forest	Inchannel/ riparian	Few	3-10
Lower Columbia River	**CO**, SH, CT	4	State/private forest	Inchannel/ riparian, other	Many	5-12
Skagit River	**CH**	13	Mixed	Estuary	Some	2-10
Wenatchee River	**CH, SH**	4-11	Mixed	Various	Many	5-10

In addition to the intensively monitored watersheds, up to 90 randomly selected restoration and protection projects are being monitored for their effectiveness in meeting the intended habitat restoration goals at the project scale. Preliminary data will be available for the next State of The Salmon Report.

The following charts and indices have been developed to illustrate what is known about changes in freshwater salmon productivity. A linear trend line has been included. R^2 values for these trend lines are low.

Puget Sound Salmon Recovery Region

Table 11. Puget Sound SRR juvenile migrant trap data.

PUGET SOUND JUVENILE MIGRANT PRODUCTION (Data taken from Tables 35-36 Appendix 2)				
Species	**Trap sites**	**Base Period Avg 1991-1998**	**Recovery Period Avg 1999-2002**	**Percent Change**
Chinook*	1	No Data	5,6357,742	**NA**
Coho	7	1,145,334	1,345,491	**+18**
Steelhead*	5	3,111	3,984	**+28**

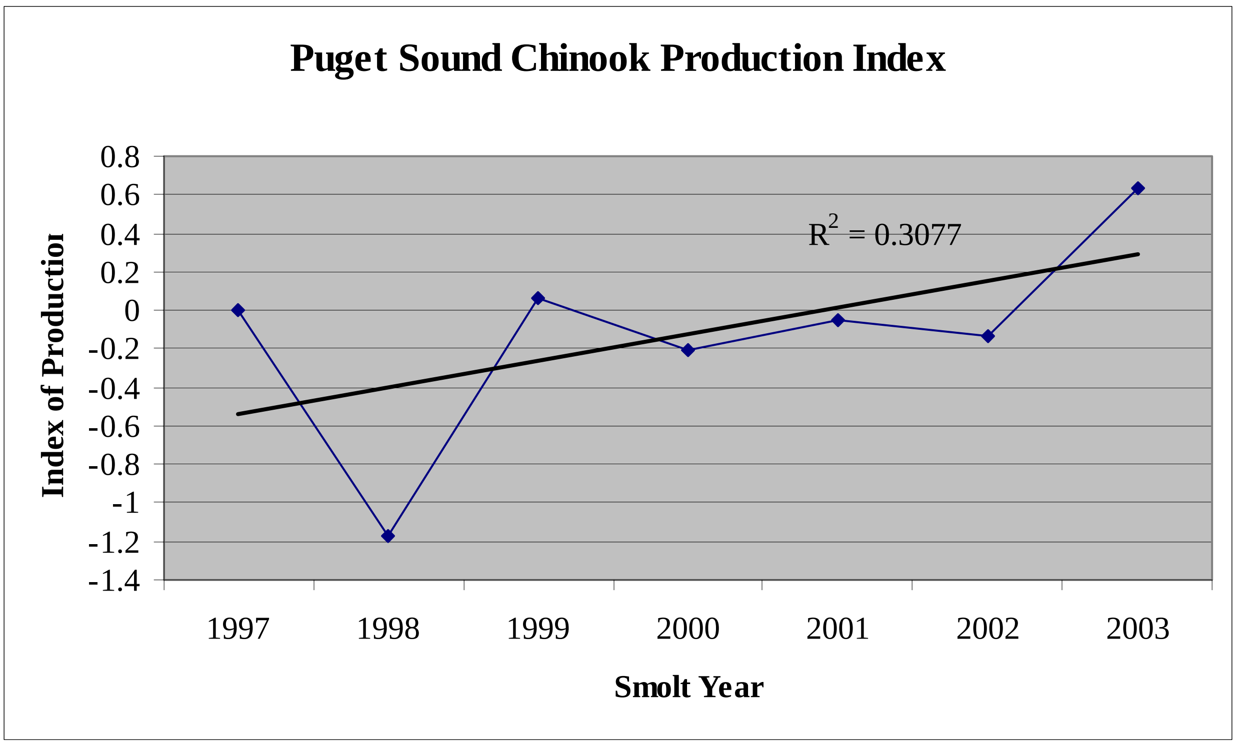

Figure 19. Puget Sound migrant production index. (For data see Appendix 2 Table 36)

Coastal Salmon Recovery Region

Table 12. Coastal SRR juvenile migrant trap data.

COASTAL JUVENILE MIGRANT PRODUCTION (Data taken from Tables 37-38 Appendix 2)				
Species	Trap sites	Base Period Avg 1991-1998	Recovery Period Avg 1999-2002	Percent Change
Coho	3	1,694,784	1,964,848	**+16**
Steelhead	1	827	874	**+6**

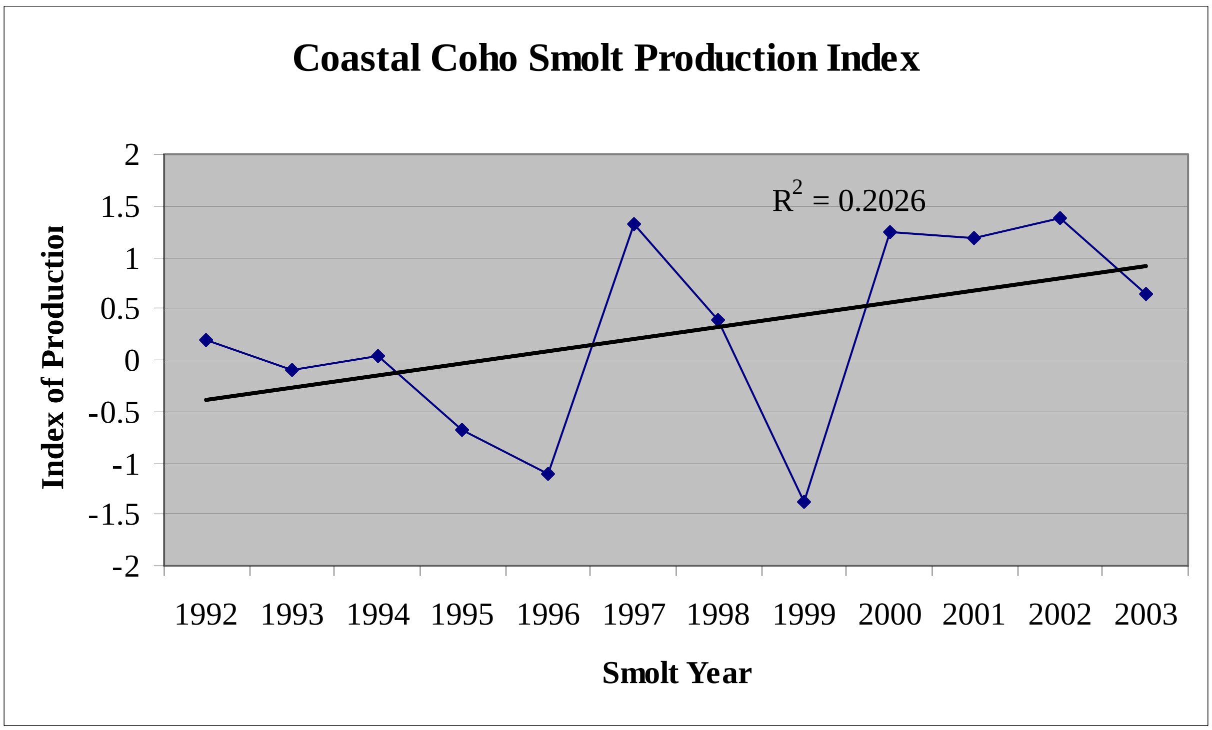

Figure 20. Coastal coho juvenile migrant productivity index.

Lower Columbia Salmon Recovery Region

Table 13. Lower Columbia SRR juvenile migrant trap data.

LOWER COLIUMBIA RIVER JUVENILE MIGRANT PRODUCTION (Data taken from Tables 39-40 Appendix 2)				
Species	Trap sites	Base Period Avg 1991-1998	Recovery Period Avg 1999-2002	Percent Change
Chinook*	1	No Data	14,722	**NA**
Coho*	5	No Data	324,281	**NA**
Steelhead*	7	68,089	83,429	**+22**

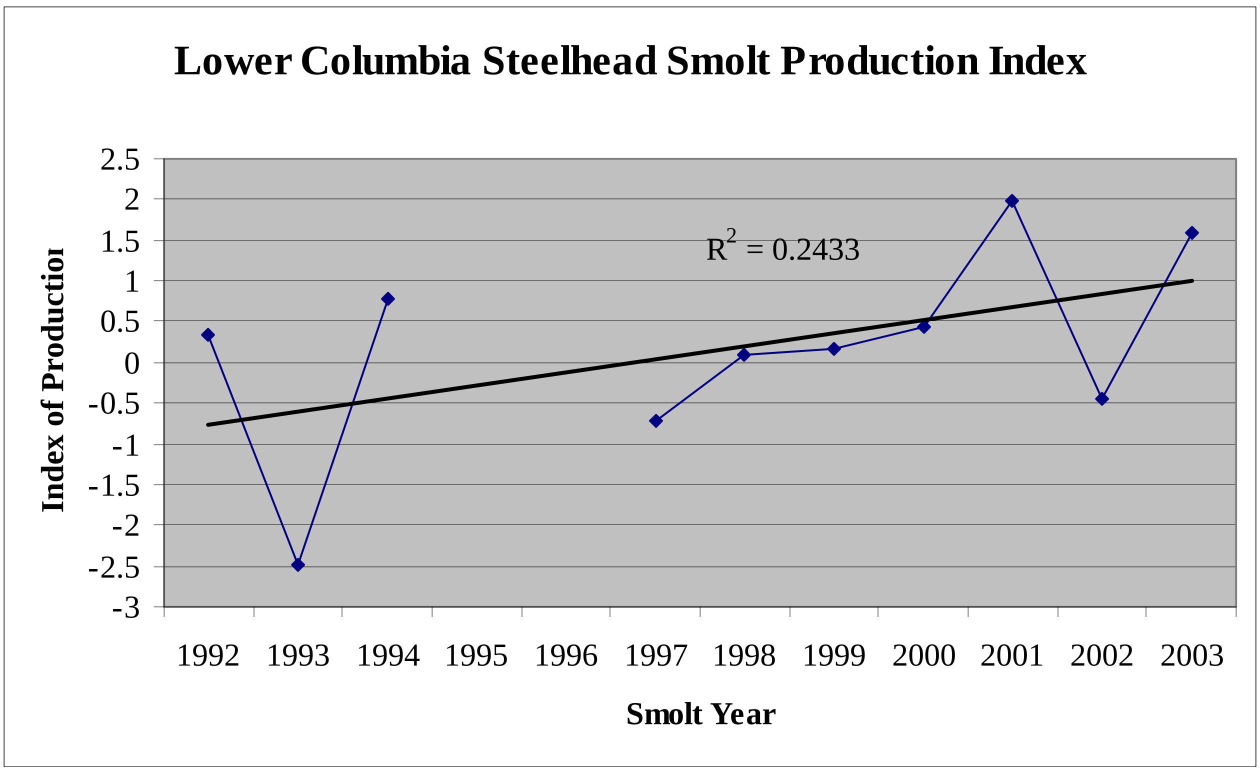

Figure 21. Lower Columbia SRR steelhead juvenile migrant production index.

Upper Columbia River Salmon Recovery Region

Table 14. Upper Columbia SRR juvenile migrant trap data.

UPPER COLUMBIA RIVER JUVENILE MIGRANT PRODUCTION (Data taken from Table 41-42 Appendix 2)				
Species	Trap sites	Base Period Avg 1991-1998	Recovery Period Avg 1999-2002	Percent Change
Chinook*	1	11,110	37,095	**+234**
Steelhead*	1	No Data	39.933	**No Data**

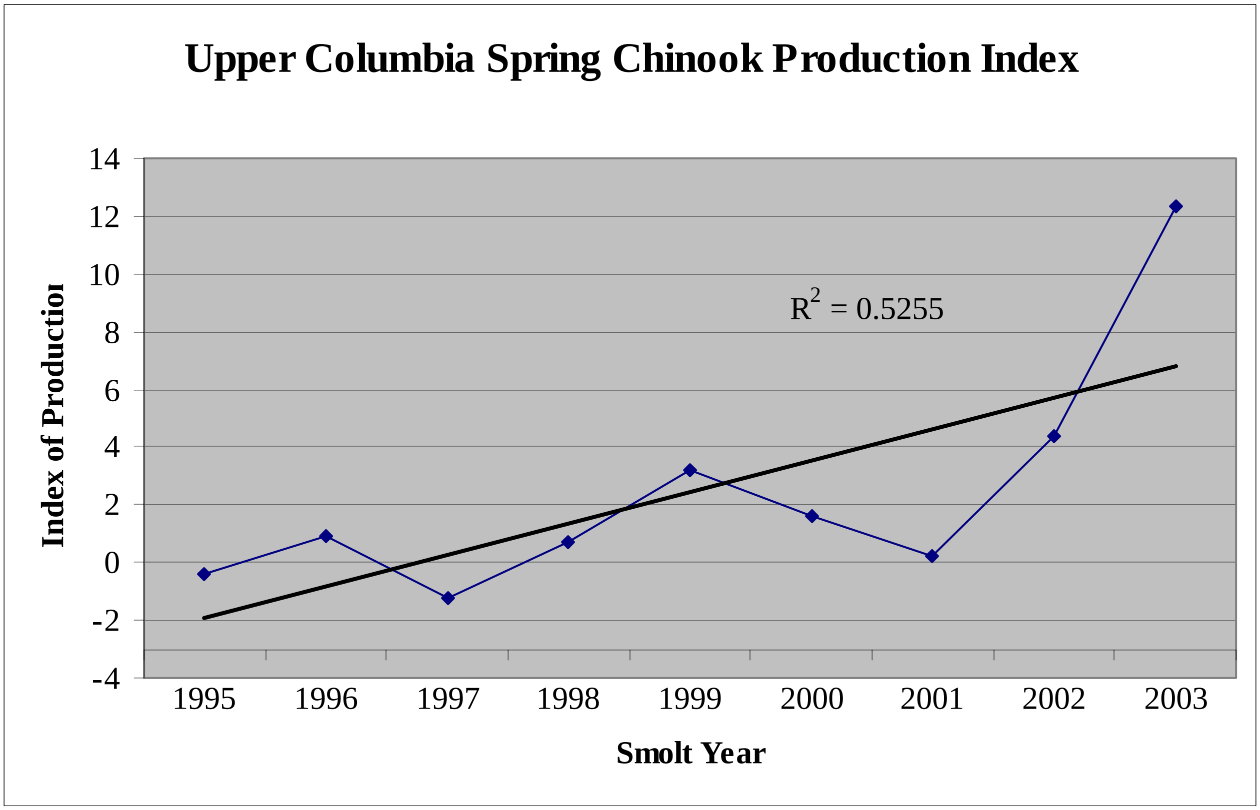

Figure 22. Upper Columbia SRR Spring Chinook juvenile migrant production index (Chiwawa River).

Snake River Salmon Recovery Region

Table 15. Snake River SRR juvenile migrant trap data.

SNAKE RIVER JUVENILE MIGRANT PRODUCTION (Data taken from Table 43-45 Appendix 2)				
Species	Trap sites	Base Period Avg 1991-1998	Recovery Period Avg 1999-2002	Percent Change
Fall Chinook*	1	8914	9739	**+9**
Spring Chinook*	1	26,355	18,569	**-30**
Steelhead*	1	19,919	26,703	**+34**

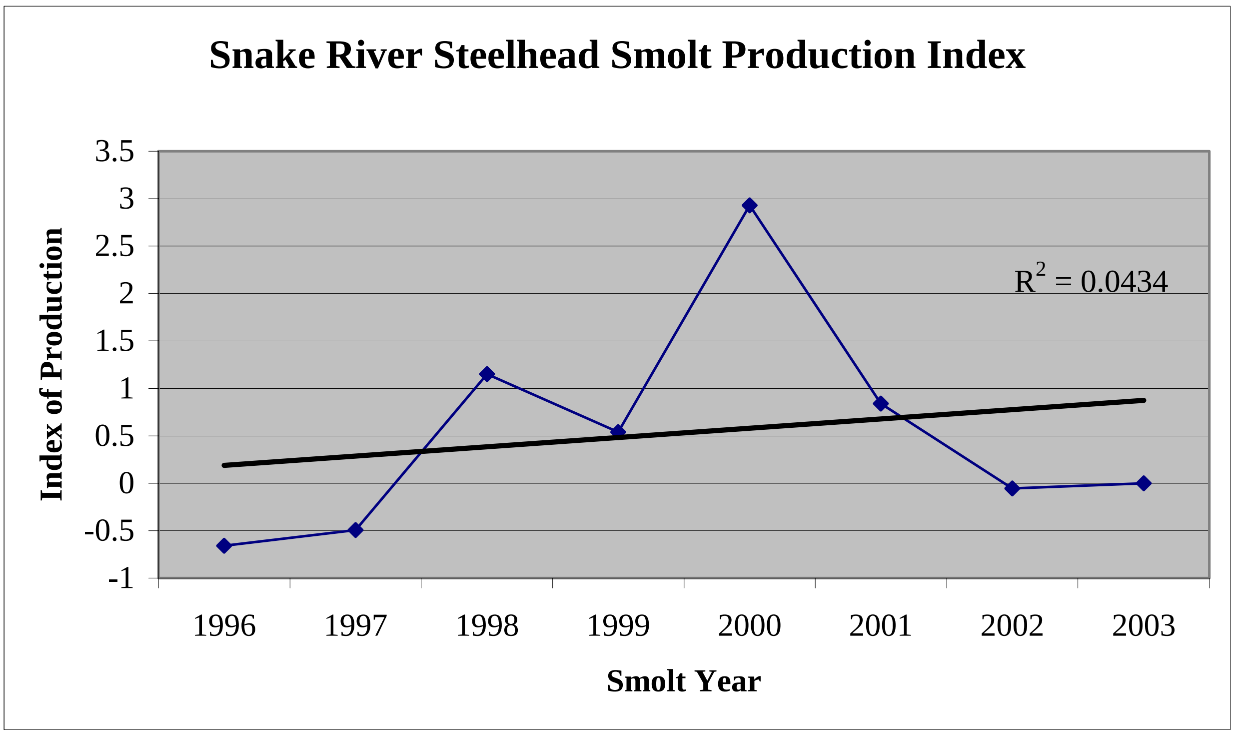

Figure 23. Snake River SRR juvenile steelhead migrant production index (Tucannon River).

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Appendix 1. Spawner Abundance Tables

Table 16. Puget Sound natural Chinook spawners by BRT population and total annual spawner abundance (data source Salmonid Hatchery Inventory and Effects Evaluation Report, NOAA Fisheries)

Population	Planning Target Lower	Planning Target Upper	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
NF Nooksack	3,800	16,000	107	483	446	45	228	538	621	366	**354**	911	1,364	4,057	4,671	NA	**2,751**
SF Nooksack	2,000	9,100	365	103	235	118	290	203	180	157	**206**	166	284	287	289	NA	**257**
Lower Skagit	3,900	16,000	1,510	1,331	942	884	666	1,521	409	2,388	**1,206**	1,043	3,262	2,606	4,866	NA	**2,944**
Upper Skagit	5,380	26,000	3,656	5,548	4,654	4,565	5,848	7,989	4,168	11,761	**6,024**	3,586	13,092	10,084	13,815	NA	**10,144**
Upper Cascade	290	1,200	135	205	168	173	225	208	308	323	**218**	83	273	625	340	NA	**330**
Lower Sauk	1,400	5,600	658	469	205	100	263	1,103	295	460	**444**	295	576	1,103	910	NA	**721**
Upper Sauk	750	3,030	747	580	323	130	190	408	305	290	**372**	180	273	543	460	NA	**364**
Suiattle	160	610	464	201	292	167	440	435	428	473	**363**	208	360	688	265	NA	**380**
NF Stillaguamish	4,000	18,000	1,331	486	583	667	599	993	930	1,292	**860**	845	1,403	1,066	1,253	NA	**1,142**
SF Stillaguamish	3,600	15,000	301	294	345	287	223	251	226	248	**272**	253	243	283	335	NA	**279**
Skykomish	8,700	39,000	2,192	2,002	1,653	2,898	2,791	3,819	2,355	4,412	**2,765**	3,455	4,665	4,575	4,325	NA	**4,255**
Snoqualmie	5,500	25,000	628	708	2,366	728	385	1,032	1,937	1,892	**1,210**	1,344	1,427	3,589	2,895	NA	**2,314**
N Lk Washington	NA	NA	153	265	89	436	249	33	67	265	**195**	537	227	459	268	NA	**373**
Cedar	NA	NA	508	525	156	452	681	303	227	432	**411**	241	120	810	369	NA	**385**
Green	NA	NA	10,548	5,267	2,476	4,078	7,939	6,026	9,967	7,312	**6,702**	11,025	6,170	7,975	13,950	NA	**9,780**
White	NA	NA	194	406	409	392	605	628	402	316	**419**	553	1,523	2,002	803	NA	**1,220**
Puyallup	5,300	18,000	1,702	3,034	1,999	1,328	2,344	2,111	1,110	1,711	**1,917**	1,988	1,193	1,915	1,590	NA	**1,672**
Nisqually	3,400	13,000	953	106	1,655	1,730	817	606	340	834	**880**	1,399	1,253	1,079	1,542	NA	**1,318**
Skokomish	NA	NA	1,719	825	960	657	1,398	995	452	1,177	**1,023**	1,692	926	1,913	1,479	NA	**1,503**
M Hood Canal	NA	NA	86	96	112	384	103	91	194	287	**169**	762	438	322	95	NA	**404**
Dungeness	NA	NA	163	158	43	65	163	183	50	110	**117**	75	218	453	663	NA	**352**
Elwha	NA	NA	1,642	479	633	163	524	364	1,578	633	**752**	813	715	643	650	NA	**705**
TOTAL 22 stocks			**29,762**	**23,571**	**20,744**	**20,447**	**26,971**	**29,840**	**26,549**	**37,139**	**26,878**	**31,454**	**40,005**	**47,077**	**55,833**	**0**	**43,592**
TOTAL 14 Eval stocks	**48,180**	**205,540**	**14,749**	**15,550**	**15,866**	**13,820**	**15,309**	**21,217**	**13,612**	**26,607**	**17,091**	**15,756**	**29,668**	**32,500**	**37,556**	**0**	**28,870**

Table 17. Puget Sound natural coho spawners by stock and total annual spawner abundance. (Data source PFMC "Review of 2003 Ocean Salmon Fisheries")

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
CO-SKGT	30,000	7,800	7,500	13,400	29,100	13,400	8,300	32,600	73,600	**23,213**	28,600	63,700	87,000	46,700	97,900	**56,500**
CO-HC	21,500	12,500	19,200	15,900	56,100	40,300	37,100	95,800	101,100	**47,250**	16,600	27,300	94,700	39,300	25,800	**44,475**
CO-STSN	87,000	45,000	97,500	62,800	182,600	109,700	59,200	69,100	177,300	**100,400**	68,300	122,500	334,600	187,300	175,300	**178,175**
TOTAL	**232,750**	**193,223**	**183,942**	**141,532**	**324,662**	**163,400**	**104,600**	**197,500**	**352,000**	**170,863**	**113,500**	**213,500**	**516,300**	**273,300**	**299,000**	**279,150**

Table 18. Puget Sound odd year natural pink salmon spawners by stock and total annual spawner abundance. (Data source PFMC "Review of 2003 Ocean Salmon Fisheries")

Stock	Goal	1991	1993	1995	1997	Base Avg.	1999	2001	2003	Recovery Avg.
PK-NOOKSACK-SAMISH	50,000	24,000	56,500	207,100	26,000	**78,400**	95,000	226,000	NA	**160,500**
PK-SKAGIT	330,000	351,000	530,000	527,000	60,000	**367,000**	320,000	894,000	NA	**607,000**
PK-STILL-SNOHOMISH	275,000	260,400	210,100	309,600	192,100	**243,050**	461,500	1,847,600	NA	**1,154,550**
PK-SOUTH PUGET	25,000	16,000	10,600	17,900	3,000	**11,875**	4,700	16,200	NA	**10,450**
Total	**680,000**	**651,400**	**807,200**	**1,061,600**	**281,100**	**700,325**	**881,200**	**2,983,800**	**NA**	**1,932,500**

Table 19. Puget Sound natural steelhead spawner abundance by stock and total annual spawner abundance. (Data source WDFW).

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
SH-GRNWR	2,000	1,983	1,757	1,872	2,346	2,691	1,933	2,403	2,614	**2,200**	1,754	1,440	1,109	1,670	NA	**1,493**
SH-NISQWR	2,000	2,618	993	804	987	NA	882	721	530	**1,076**	411	240	353	366	NA	**343**
SH-PUYWR	2,000	2,313	1,596	1,631	2,146	1,366	1,388	1,203	1,702	**1,668**	1,249	1,047	940	596	NA	**958**
SH-SKGTWR	6,000	7,514	6,900	6,412	7,656	NA	NA	7,448	7,870	**7,300**	3,780	4,584	5,394	6,818	NA	**5,144**
Total	**12,000**	**14,428**	**11,246**	**10,719**	**13,135**	**4,057**	**4,203**	**11,775**	**12,716**	**12,244**	**7,194**	**7,311**	**7,796**	**9,450**	**NA**	**7,938**

Table 20. Puget Sound chum salmon natural spawner abundance. (Data source WDFW)

Extreme terminal name and area	1991	1992	1993	1994	1995	1996	1997	1998	Baseline	1999	2000	2001	2002	2003	Recovery
Dungeness R.	241	53	771	342	71	284	510	195	**308**	175	30	209	628	138	**236**
Elwha R.	1	1	1	1	1	1	1	1	**1**	1	1	1	1	1	**1**
Misc. Straits streams	1,510	5,277	4,839	2,148	445	1,783	3,199	1,223	**2,553**	1,096	188	1,309	3,944	866	**1,481**
Strait Juan de Fuca total	**1,752**	**5,331**	**5,611**	**2,491**	**517**	**2,068**	**3,709**	**1,419**	**2,862**	**1,272**	**219**	**1,519**	**4,573**	**1,005**	**1,718**
Misc. 7A (Dakota Cr.)	0	0	0	0	4	0	0	0	**1**	0	0	0	1	2	**1**
Area 7-7A Independents total	**0**	**0**	**0**	**0**	**4**	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**1**	**2**	**1**
Nooksack R.	27,888	29,137	19,855	83,502	30,621	31,969	13,198	50,911	**35,885**	19,547	3,760	35,148	46,449	95,898	**40,160**
Samish R.	2,282	11,450	4,723	3,935	2,077	591	382	5,985	**3,928**	7,073	350	3,503	7,040	2,083	**4,010**
Misc. 7B, 7C streams	1,133	2,696	726	4,720	3,158	3,450	1,543	5,786	**2,902**	3,773	494	6,759	8,774	6,147	**5,189**
Nooksack-Samish. Basin total	**31,303**	**43,283**	**25,304**	**92,157**	**35,856**	**36,010**	**15,123**	**62,682**	**42,715**	**30,393**	**4,604**	**45,410**	**62,263**	**104,128**	**49,360**
Skagit R.	22,000	95,940	16,673	121,775	38,666	74,474	14,392	120,875	**63,099**	34,311	22,321	72,980	209,478	17,629	**71,344**
Skagit River total	**22,000**	**95,940**	**16,673**	**121,775**	**38,666**	**74,474**	**14,392**	**120,875**	**63,099**	**34,311**	**22,321**	**72,980**	**209,478**	**17,629**	**71,344**
Area 12 Hood Canal	1,350	1,270	788	2,936	1,445	2,572	1,395	3,161	**1,865**	1,469	351	2,703	4,027	5,827	**2,876**
Area 12B Hood Canal	11,861	34,926	19,342	55,867	48,047	115,036	29,017	47,059	**45,144**	9,331	16,680	27,277	85,784	63,058	**40,426**
Area 12A Hood Canal	4,909	2,780	3,642	26,551	15,452	11,355	3,558	874	**8,640**	5,029	235	5,425	11,400	5,696	**5,557**
Area 12C Hood Canal Except Skok. R.	13,244	28,530	14,888	28,253	22,701	37,967	5,832	17,724	**21,142**	8,773	4,559	20,758	29,522	36,559	**20,034**
Skokomish R. Drainage	6,231	12,866	18,222	20,889	4,421	12,722	7,287	9,716	**11,544**	2,896	6,973	14,077	13,668	9,861	**9,495**
Area 12D Hood Canal	7,150	16,009	10,889	17,326	27,883	72,152	6,404	23,098	**22,614**	6,425	8,465	33,473	28,635	29,251	**21,250**
Hood Canal total	**44,745**	**96,382**	**67,770**	**151,821**	**119,949**	**251,803**	**53,492**	**101,631**	**110,949**	**33,924**	**37,264**	**103,713**	**173,037**	**150,252**	**99,638**

Adult Spawner Abundance Index

Extreme terminal name and area	1991	1992	1993	1994	1995	1996	1997	1998	Baseline	1999	2000	2001	2002	2003	Recovery
Snohomish R.	13,783	32,878	10,049	100,035	29,964	49,221	8,320	102,890	**43,393**	51,575	10,557	35,086	155,601	100,446	**70,653**
Stillaguamish R.	9,220	36,372	10,524	137,854	19,472	97,550	2,908	131,514	**55,677**	36,287	23,795	41,402	214,901	61,799	**75,637**
Still.-Snohom. Basin total	**23,003**	**69,250**	**20,573**	**237,889**	**49,436**	**146,771**	**11,228**	**234,404**	**99,069**	**87,862**	**34,352**	**76,488**	**370,502**	**162,245**	**146,290**
Area 10 streams	980	319	725	3,845	994	1,816	885	5,981	**1,943**	2,560	1,381	5,773	7,531	7,714	**4,992**
Green-Duwamish R.	1	1	1	1	1	1	1	1	**1**	1	1	1	1	1	**1**
Area 10E streams	29,783	43,556	28,259	44,443	38,103	56,992	5,971	119,814	**45,865**	54,467	7,668	57,262	81,359	81,682	**56,488**
Area 11 streams	3,389	3,769	8,313	7,868	10,644	3,402	1,864	3,728	**5,372**	1,560	2,618	6,552	7,759	5,993	**4,896**
Puyallup R. Drainage (Area 11A)	738	1,418	2,253	4,008	3,133	638	3,019	**2,132**	1,473	2,277	10,731	14,586	8,580	**7,529**	**7,529**
Area 13 streams	1	1	1	1	1	1	1	1	**1**	1	1	1	1	1	1
Area 13C streams	94	0	0	0	0	0	0	0	**12**	0	13	0	0	0	3
Nisqually R. Drainage	1	1	1	1	1	1	1	1	**1**	1	1	1	1	1	1
Area 13A streams	537	904	1,922	1,147	17,259	12,293	4,018	19,901	**7,248**	10,925	19,615	19,106	14,511	11,759	15,183
Area 13B streams	46,306	89,516	93,052	177,564	129,581	251,436	56,494	215,009	**132,370**	78,649	61,561	174,850	136,585	147,561	119,841
South Sound total	**82,943**	**138,805**	**133,691**	**237,123**	**200,592**	**329,074**	**69,872**	**367,456**	**194,945**	**149,638**	**95,136**	**274,278**	**262,334**	**263,291**	**288,938**
Totals	**205,747**	**448,991**	**269,622**	**843,256**	**445,020**	**840,200**	**167,816**	**888,467**	**513,640**	**337,400**	**193,896**	**574,388**	**1,082,188**	**698,552**	**577,285**

Table 21. ESA listed Puget Sound natural summer chum salmon spawner abundance by population and total. (Data source WDFW and "Summer Chum Conservation Initiatives, Supplemental Report #5)

Population	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Baseline	1999	2000	2001	2002	2003	Recovery
Tahuya		5	0	0	0	0	5	0	0	**2**	1	2	0	0	0	**1**
Union	340	208	140	251	738	721	494	410	223	**384**	159	744	1,491	872	11,916	**3,036**
L. Quilcene		1	9	12	0	54	265	29	265	**71**	84	268	199	470	890	**382**
B. Quilcene	2060	49	734	136	722	4,520	9,250	7,874	2,788	**2,898**	3,153	5,630	6,174	4,017	11,843	**6,163**
Big Beef		0	0	0	0	0	0	0	0	**0**	4	20	894	742	896	**511**
Anderson		0	0	0	0	0	0	0	0	**0**	0	0	0	0	0	**0**
Dosewallips	1,930	250	655	105	225	2,787	6,976	47	336	**1,265**	351	1,260	990	1,627	7,066	**2,259**
Duckabush	2,060	102	617	105	263	825	2,650	475	226	**589**	92	464	942	530	1,869	**779**
Hamma	3,790	71	123	69	370	476	774	104	127	**245**	255	229	1,227	2,328	854	**979**
Lilliwaup	1,960	30	99	77	111	79	76	27	24	**58**	13	22	92	858	353	**268**
Dewatto		31	0	1	0	0	0	6	12	**6**	2	10	32	10	9	**13**
Chimacum		0	0	0	0	0	0	0	0	**0**	38	52	903	864	558	**483**
Snow		12	21	11	2	25	160	67	27	**40**	29	30	154	532	304	**210**
Salmon	970	172	433	452	161	591	894	834	1,144	**547**	499	846	2,638	5,517	5,651	**3,030**
JCL	330	125	616	110	15	223	30	61	98	**149**	7	55	260	42	446	**162**
Total	**14,240**	**1,056**	**3,447**	**1,329**	**2,607**	**10,301**	**21,574**	**9,934**	**5,270**	**6,254**	**4,687**	**9,632**	**15,996**	**18,409**	**42,655**	**18,276**

Table 22. Coastal Washington natural Chinook spawner abundances. (Data source PFMC "Review of 2003 Ocean Salmon Fisheries" and personal communication Curt Holste Montesano Office WDFW for 2003 data.)

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base	1999	2000	2001[6]	2002	2003	Recovery
CH-WILL	4,400	7,500	13,100	6,300	4,800	10,200	6,300	11,000	7,100	**8,288**	3,400	8,200	5,500	6,500	9,749	**5,900**
CH-GH-SP	1,400	1,300	1,700	1,300	1,400	2,100	4,500	4,500	2,300	**2,388**	2,900	2,900	2,900	2,600	1,929	**2,825**
CH-GHF	14,600	14,400	16,900	13,300	14,300	12,700	20,200	18,200	12,500	**15,313**	7,800	4,900	8,300	10,000	15,657	**7,750**
CH-QUEE-F	2,500	4,486	4,695	3,383	3,805	2,876	3,441	2,477	3,951	**3,639**	1,933	3,572	2,859	1,938	4,993	**2,576**
CH-HOH-S	900	1,078	1,018	1,411	1,699	1,132	1,371	1,826	1,287	**1,353**	928	492	1,159	2,464	1,228	**1,261**
CH-HOH-F	1,200	1,420	4,003	2,280	3,967	2,202	3,022	1,773	4,257	**2,866**	1,924	1,749	2,560	4,415	1,417	**2,662**
CH-QUIL-SP	1,200	1,188	1,009	1,292	974	1,333	1,170	890	1,599	**1,182**	713	989	1,225	1,002	1,065	**982**
CH-QUIL-F	3,000	6,292	6,342	5,254	4,932	5,532	7,316	5,405	6,752	**5,978**	3,334	3,730	5,136	6,057	4,578	**4,564**
Total	**29,200**	**37,664**	**48,767**	**34,520**	**35,877**	**38,075**	**47,320**	**46,071**	**39,746**	**41,005**	**22,932**	**26,532**	**29,639**	**34,976**	**40,616**	**28,520**

Table 23. Coastal Washington natural coho spawner abundances. (Data source PFMC "Review of 2003 Ocean Salmon Fisheries" and personal communication Curt Holste WDFW, Montesano Office for 2003 data.)

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001[7]	2002	2003	Recovery Avg.
CO-GH	35,400	64,300	32,900	25,500	12,400	47,400	63,600	22,500	35,600	**38,025**	33,300	35,900	56,800	56,800	NA	**45,700**
CO-QUEE	5,800	6,525	6,266	5,020	1,105	6,181	8,993	1,851	4,102	**5,005**	4,791	7,939	23,793	13,772	15,972	**12,574**
CO-HOH	2,000	4,129	4,045	1,345	1,161	4,710	4,858	1,386	4,418	**3,257**	4,594	6,772	10,773	9,009	5,115	**7,787**
CO-QUIL-F	6,300	9,532	8,170	4,165	4,882	10,035	11,009	4,623	13,866	**8,285**	9,365	13,343	18,876	23,016	14,370	**16,150**
TOTAL	**49,500**	**159,814**	**148,915**	**105,070**	**91,302**	**144,476**	**183,100**	**122,502**	**137,478**	**54,572**	**97,914**	**117,018**	**169,520**	**172,549**	**116,689**	**82,211**

[6] 2001-2003 spawner data for Chinook provided by Curt Holste WDFW Montesano
[7] 2001-2003 spawner data for coho provided by Curt Holste WDFW Montesano

Table 24. Coastal steelhead combined natural spawner abundance for 5 stocks. (Data source is WDFW Fish Program records.)

Stock	Goal	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	Base Avg.	1999-00	2000-01	2001-02	2002-03[8]	2003-04	Recovery Avg.
SH-CHEHWR	8,600	7,652	5,904	8,391	8,713	6,783	5,689	5,964	10,720	**7,477**	11,678	9,802	10,440	8,424	NA	**10,086**
SH-HOHWR	6,462	2,061	2,053	2,239	2,204	2,340	3,008	3,689	3,095	**2,586**	3,162	2,767	2,811	1,616	NA	**2,589**
SH-HUMPWR	1,600	2,538	2,136	1,390	2,053	1,454	1,012	1,344	1,970	**1,737**	1,315	1,322	2,522	2,658	NA	**1,954**
SH-QUILWR	5,900	5,514	6,270	7,283	10,926	15,191	10,558	16,949	16,502	**11,149**	14,664	12,584	11,242	8,724	NA	**11,804**
SH-QUINWR	1,200	1,192	1,156	1,299	1,208	1,177	1,745	1,307	1,133	**1,277**	1,470	1,612	1,514	1,572	NA	**1,542**
Total	23,762	**18,957**	**17,519**	**20,602**	**25,104**	**26,945**	**22,012**	**29,253**	**33,420**	**24,227**	**32,289**	**28,087**	**28,529**	**22,994**	NA	**27,975**

Table 25. Coastal chum natural spawner abundance for 2 stocks. (Data source WDFW, http://wdfw.wa.gov/fish/chum/chum.6.d.htm)

Stock	Goal[9]	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
CHUM GH	21,000	17,936	38,300	21,059	24,592	12,616	12,413	13,456	35,188	**21,945**	12,260	8,942	24,898	56,175	37,947	**28,044**
CHUM WP	35,400	33,969	37,068	31,017	30,526	24,695	20,011	33,286	65,092	**34,458**	24,512	40,030	29,389	59,243	47,347	**40,104**
Total	**56,400**	**51,905**	**75,368**	**52,076**	**55,118**	**37,311**	**32,424**	**46,742**	**100,280**	**56,403**	**36,772**	**48,972**	**54,287**	**115,418**	**85,294**	**68,149**

Table 26. Ozette Lake sockeye natural beach spawner abundance. (Data source Caroline Peterschmidt Makah Tribe) Data from tributary streams not included in this index.

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
SOCKEYE[10]	NA	684	2548	NA	585	270	1699	998	1310	**1,156**	1676	1293	591	2252	NA	**1,453**

[8] 2001-2003 spawner data for steelhead provided by Curt Holste and Mike Gross WDFW Montesano
[9] Spawner goals and 2001-2003 coastal chum data provided by Curt Holste
[10] Data reflects only beach spawning populations. Other populations have been established but their importance has not been resolved.

Table 27. Lower Columbia steelhead natural spawner abundance for 10 stocks. (Data source WDFW Fish Program records)

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
SH-ABERWR	**306**	246	88	58	34	16	64	146	78	**91**	216	206	196	240	NA	**215**
SH-COWEWR	**1064**	N/A	438	362	252	44	108	486	198	**270**	530	384	298	460	NA	**418**
SH-ELOCWR	**626**	278	378	230	62	52	64	136	116	**165**	402	392	232	368	NA	**349**
SH-GERMWR	**202**	NA	216	108	42	40	46	90	110	**93**	164	252	158	102	NA	**169**
SH-GRYSWR	**1,486**	1,224	1,086	704	426	329	158	756	408	**636**	1,040	1,130	724	1,200	NA	**1,024**
SH-KALAWR	**1,000**	1,974	843	725	1,030	725	534	396	502	**841**	824	953	1,402	1,699	NA	**1,220**
SH-LEWIWR	**204**	88	90	78	53	NA	192	420	476	**200**	NA	328	474	652	NA	**485**
SH-SKAMWR	**227**	304	258	208	92	112	128	208	200	**189**	248	264	144	300	NA	**239**
SH-TOUTWR	**1,058**	1,290	1,242	632	396	150	388	374	562	**629**	490	348	640	1,510	NA	**747**
SH-WASHWR	**520**	142	118	158	206	NA	92	195	294	**172**	NA	216	286	764	NA	**422**
Total	**6,693**	**5,546**	**4,757**	**3,263**	**2,593**	**1,468**	**1,774**	**3,207**	**2,944**	**3,286**	**3,914**	**4,473**	**4,554**	**7,295**	NA	**5,286**

Table 28. Lower Columbia River Chinook spawner abundance. (Data sources PSC CTT, 2003 and Guy Norman, Cramer and Associates)

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
FCH-LRW	**6,500**	9,066	6,307	7,025	9,939	9,718	13,971	8,670	5,935	**8,829**	3,184	9,820	13,886	16,380	18,505	**10,817**
FCH-COWEEM	**3,000**	174	424	327	535	774	2,148	1,328	144	**732**	93	126	646	891	NA	**439**
FCH-EFL	**1,900**	230	202	156	395	100	167	184	52	**186**	109	323	530	1296	NA	**565**
Total	**4,900**	9,470	6,933	7,508	10,869	10,592	16,286	10,182	6,131	**9,747**	3,386	10,269	15,062	18,567	NA	**11,821**

Table 29. Lower Columbia River chum spawner abundance (Data source Lower Columbia Salmon and Steelhead Recovery and Sub-Basin Plan Technical Foundation, Vol. 1)

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
CMGrays	**NA**	104/mi	461/mi	199/mi	42/mi	140/mi	242/mi	146/mi	171/mi	**188/mi**	316/mi	501/mi	759/mi	1,587/mi	NA	**791/mi**
CMHamilt	**NA**	27/mi	213/mi	29/mi	99/mi	29/mi	123/mi	207/mi	400/mi	**141/mi**	260/mi	284/mi	987/mi	888/mi	NA	**605/mi**
CMHardy	**NA**	125/mi	635/mi	324/mi	264/mi	130/mi	125/mi	105/mi	443/mi	**269/mi**	157/mi	20/mi	711/mi	416/mi	NA	**326/mi**
CMIndex Combined	**1,519/mi**	95/mi	461/mi	199/mi	72/mi	128/mi	215/mi	146/mi	231/mi	**193/mi**	291/mi	398/mi	785/mi	1,293/mi	NA	**692/mi**

Table 30. Mid Columbia upriver bright Chinook and steelhead spawner abundance. (Data source PFMC "Review of 2003 Ocean Salmon Fisheries")

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
CH-URB	40,000	46,600	51,200	54,900	85,900	68,200	73,900	67,100	63,800	**63,950**	78,400	66,400	110,500	141,600	173,700	**99,225**
SH-YAKISR	10,500[11]	834	2,263	1,184	554	925	505	1,106	1,113	**1,061**	1,070	1,296	2,942	4,525	2,201	**2,458**
SH-WALLASR	2,600[10]	NA	NA	722	423	340	257	231	302	**379**	224	410	600	1,205	547	**610**
SH Total	**13,100**	**834**	**2,263**	**1,906**	**977**	**1,265**	**762**	**1,337**	**1,415**	**1,440**	**1,294**	**1,706**	**3,542**	**5,730**	**2,748**	**3,068**

Table 31. Upper Columbia spring Chinook natural spawner abundance. (Data source NOAA "Salmonid Hatchery Inventory and Effects Evaluation Report")

.Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
CH-Wen SP	3,750[10]	576	1,097	685	185	51	122	183	119	**377**	91	363	1,243	747	359	**560**
CH ENTIAT SP	500[10]	NA	NA	0	112	43	53	122	79	**82**	89	101	500	211	274	**235**
CH METH SP	2,000[10]	620	1,479	1,095	269	46	1	234	1	**468**	67	122	2016	353	69	**525**
Total	**6,250**	**1,196**	**2,576**	**1,780**	**566**	**140**	**176**	**539**	**199**	**927**	**247**	**586**	**3,759**	**1,311**	**702**	**1,320**

Table 32. Upper Columbia sockeye and steelhead natural spawner abundance. (Data source NOAA "Salmonid Hatchery Inventory and Effects Evaluation Report")

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg.
SOK Wen	23,000	71,200	77,700	79,200	11,800	8,700	28,000	42,700	10,000	**41,163**	15,300	83,600	NA	NA	NA	**49,450**
SH Wen SR	2,500[10]	1,612	1,050	510	454	709	351	495	488	**709**	515	1,497	4,391	2,063	1,224	**2,117**

[11] Interim spawner goals Lohn letter to Frank L. Cassidy

Table 33. Snake River Chinook natural spawner abundance (Data source NOAA "Salmonid Hatchery Inventory and Effects Evaluation Report")

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	Recovery Avg
CH-SNR-SP[12]	25,000	2,206	11,134	5,871	1,416	745	1,358	2,126	5,089	**3,743**	594	3,266	16,477	34,144	38,638	**13,620**
CH-SNR-F[10]	2,500	318	549	742	406	350	639	797	306	**513**	905	943	5,163	2,116	3,856	**2,597**
Total	**27,500**	**2,524**	**11,683**	**6,613**	**1,822**	**1,095**	**1,997**	**2,923**	**5,395**	**4,257**	**1,499**	**4,123**	**19,129**	**40,751**	**42,492**	**16,217**

Table 34. Snake River steelhead natural spawner index abundance. (Data source WDFW Dayton laboratory represents a partial estimate)

Stock	Goal	1991	1992	1993	1994	1995	1996	1997	1998	Base Avg.	1999	2000	2001	2002	2003	2004	Recov Avg.
SH-TCHTSR	600[13]	193	374	484	358	388	NA	NA	474	**379**	271	217	253	NA	NA	133	**247**
SH-TUCNSR	1300[11]	210	166	94	151	147	71	NA	NA	**140**	138	31	198	NA	NA	59	**122**
SH-ASTNSR	400[11]	750	116	99	148	256	NA	NA	119	**248**	371	231	543	NA	NA	521	**382**
Total	**1,700**	**960**	**282**	**193**	**299**	**403**	**0**	**0**	**0**	**380**	**509**	**262**	**741**	**0**	**0**	**580**	**504**

[12] Lower Granite Dam Counts and Lower Granite Dam spawner goal
[13] SASI Spawner goal

Appendix 2. Juvenile Migrant Trap Data Tables

Table 35. Puget Sound juvenile migrant trap location data.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Skagit River	NA	NA	NA	NA	NA	4,500,000	2,400,000	6,400,000	1,700,000	6,000,000	5,000,000	5,500,000
Bear Creek	NA	NA	NA	NA	NA	NA	NA	15,002	32,220	10,588	20,700	17,300
Cedar River	NA	NA	NA	NA	NA	NA	NA	80,932	69,339	32,249	126,500	235,400
Green River	NA	NA	NA	NA	NA	NA	NA	ND	535,708	728,218	412,460	674,397

Table 36. Puget Sound juvenile migrant production index by trap site and year.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Skagit River	NA	NA	NA	NA	NA	0	-1.16907	1.057734	-1.55877	0.835053	0.278351	0.556702
Bear Creek	NA	NA	NA	NA	NA	NA	NA	-0.50902	1.597786	-1.04912	0.188191	-0.22784
Cedar River	NA	NA	NA	NA	NA	NA	NA	-0.35691	-0.50493	-0.97851	0.22493	1.61542
Green River	NA	NA	NA	NA	NA	NA	NA	NA	-0.36556	0.988109	-1.2322	0.60966
Index	NA	NA	NA	NA	NA	0	-1.16907	0.063936	-0.20787	-0.05112	-0.13518	0.638486

Table 37. Coastal coho juvenile migrant abundance trap location data.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bingham	22,584	20,763	20,183	17,523	23,335	70,342	48,133	15,592	57,025	42,473	29,150	34,410
Chehalis	ND	1,471,254	2,385,157	1,174,326	5,029,17.8	1,910,068	2,198,298	555,538	1,408,940	2,060,798	3,389,156	ND
Clearwater	69,700	63,200	49,900	45,000	35,000	81,000	47,800	27,000	99,354	93,469	83,312	74,415

Table 38. Coastal coho juvenile migrant production index by trap site and year.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Bingham	-0.46566	-0.5573	-0.58647	-0.72031	-0.42788	1.937604	0.820004	-0.81751	1.267464	0.535183	-0.13524	0.129439
Chehalis	NA	-0.19308	1.10677	-0.6154	-1.57034	0.431049	0.841	-1.4955	-0.28171	0.645433	2.534761	NA
Clearwater	0.861236	0.454318	-0.3783	-0.68505	-1.31108	1.568649	-0.50977	-1.81191	2.717661	2.349244	1.713386	1.156409
Index	0.19779	-0.09869	0.047334	-0.67359	-1.1031	1.312434	0.383746	-1.37497	1.234473	1.17662	1.370968	0.64292

Table 39. Lower Columbia steelhead juvenile migrant trap site and year data.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Germany	NA	NA	NA	NA	NA	NA	NA	NA	NA	7,600	7,023	5,936
Mill	NA	NA	NA	NA	NA	NA	NA	NA	NA	1,708	3,102	1,383
Abernathy	NA	NA	NA	NA	NA	NA	NA	NA	NA	9,905	5,300	4,141
Kalama	23,768	8,558	26,218	NA	NA	NA	15,902	21,552	31,724	43,679	45,381	49,832
Cedar	NA	NA	NA	NA	NA	NA	6,648	2,268	3,114	3,565	2,690	1,808
Cowlitz F	NA	NA	NA	NA	NA	7,714	24,505	25,368	26,184	30,861	9,300	21,565
Wind	NA	NA	NA	NA	NA	21,442	25,297	22,812	19,690	25,327	9,374	21,049

Table 40. Lower Columbia steelhead juvenile migrant production index by trap site and year.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Germany	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mill	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Abernathy	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Kalama	0.334957	-2.48707	0.789524	NA	NA	NA	-1.12448	-0.07619	1.81109	4.02919	4.34498	5.17080
Cedar	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cowlitz F	NA	NA	NA	NA	NA	-0.70711	0.707107	0.779793	0.84852	1.242438	-0.57353	0.459487
Wind	NA	NA	NA	NA	NA	-0.70711	0.707107	-0.20452	-1.34983	0.718112	-5.13427	-0.85128
Index	0.334957	-2.48707	0.789524	NA	NA	-0.70711	0.096578	0.16636	0.436594	1.996581	-0.45427	1.593004

Table 41. Upper Columbia Chinook and steelhead juvenile migrant trap data by year.

Trap Site	1995	1996	1997	1998	1999	2000	2001	2002	2003
Chiwawa Chinook	8,662	16,472	3,830	15,475	30,254	20,674	12,431	37,271	84,843
Wenatchee Steelhead	NA	NA	NA	NA	NA	47,780	34,568	33,179	44,204

Table 42. Upper Columbia Chinook and steelhead juvenile production index by year.

Trap Site	1995	1996	1997	1998	1999	2000	2001	2002	2003
Chiwawa Chinook	-0.41025	0.898735	-1.22012	0.731633	3.208653	1.603007	0.221447	4.38473	12.35799
Wenatchee Steelhead	NA	NA	NA	NA	NA	1.094492	-0.74825	-0.94198	0.595731

Table 43. Tucannon River steelhead juvenile migrant numbers and production index by year.

Trap Site	1996	1997	1998	1999	2000	2001	2002	2003
Tucannon	14,667	15,994	29,096	24,229	43,282	26,612	19,471	19,919
Index	-0.65854	-0.49215	1.15070	0.54043	2.92947	0.83923	-0.05617	0.00000

Table 44. Tucannon River fall Chinook juvenile migrant numbers and production index by year.

Trap Site	1997	1998	1999	2000	2001	2002	2003
Tucannon	25	17,803	469	11,822	6,012	16,082	14,310
Index	-0.70711	0.707107	-0.67179	0.231327	-0.23085	0.570204	0.429244

Table 45. Tucannon River spring Chinook juvenile migrant numbers and production index by year.

Trap Site	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Tucannon	49,500	26,000	50,800	49,600	6,900	75	1,612	21,057	5,508	8,157	20,045	38,079
Index	0.978763	-0.015025	1.0337384	0.9829918	-0.822741	-1.111363	-1.046365	-0.224058	-0.881607	-0.769584	-0.266855	0.4957822

Appendix 3. Puget Sound Chinook Spawner Abundance Planning Ranges

Table 46. Comparison of various spawner abundance targets for Puget Sound Chinook populations.

Stock	**US v Wa[14]**	**TRT[15] Planning Range**		**CMP[16]**		**Planning Targets Used By Shared Strategy[17]**	
	Goal	**Upper**	**Low**	**Low**	**Upper**	**Low**	**Upper**
Nooksack	4,000	39,000	25,100	2,000	4,000	5,800	25,100
Skagit summer/fall	14,900	71,500	43,400	4,800	14,500	13,880	52,440
Skagit spring	3,000	Combined	Combined	576	2000	Combined	Combined
Stillaguamish	2,000	44,000	33,000	650	900	7,600	33,000
Snohomish	5,250	84,000	34,000	2,800	4,600	14,200	64,000
Cedar	1,200	NA	NA	200	1,200	NA	NA
Green	5,800	NA	NA	1,800	5,800	NA	NA
White	1,000	NA	NA	200	1,000	NA	NA
Puyallup	500	33,000	17,000	500	500	5,300	18,000
Nisqually	1,100	17,000	13,000		1,100	3,400	13,000
Skokomish	3,150	NA	NA	800	1,650	NA	NA
Hood Canal	750	4,700	3,700	400	750	NA	NA
Dungeness	925	8,100	4,700	500	925	NA	NA
Elwha	2,700	NA	NA	1,000	2,900	NA	NA
Western JDF	850	NA	NA	500	850	NA	NA
TOTAL	**47,125**	**301,300[18]**	**173,900**	**16,726**	**42,675**	**48,180**	**205,540**

[14] Established spawner goals as published in Pacific Fishery Management Council. 2004. Review of 2003 Ocean Salmon Fisheries.
[15] Puget Sound Technical Review Team. 2002. Planning ranges and preliminary guidelines for the delisting and recovery of the Puget Sound Chinook Salmon Evolutionarily Significant Unit.
[16] Puget Sound Indian Tribes and Washington Department of Fish and Wildlife. 2004. Comprehensive Management Plan For Puget Sound Chinook, Harvest Management Component.
[17] Planning targets developed by the Puget Sound Indian Tribes and Washington Department of Fish and Wildlife and used by the Shared Strategy for developing recovery plans.
[18] Numbers will obviously be higher when all NA rows have been completed.